This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

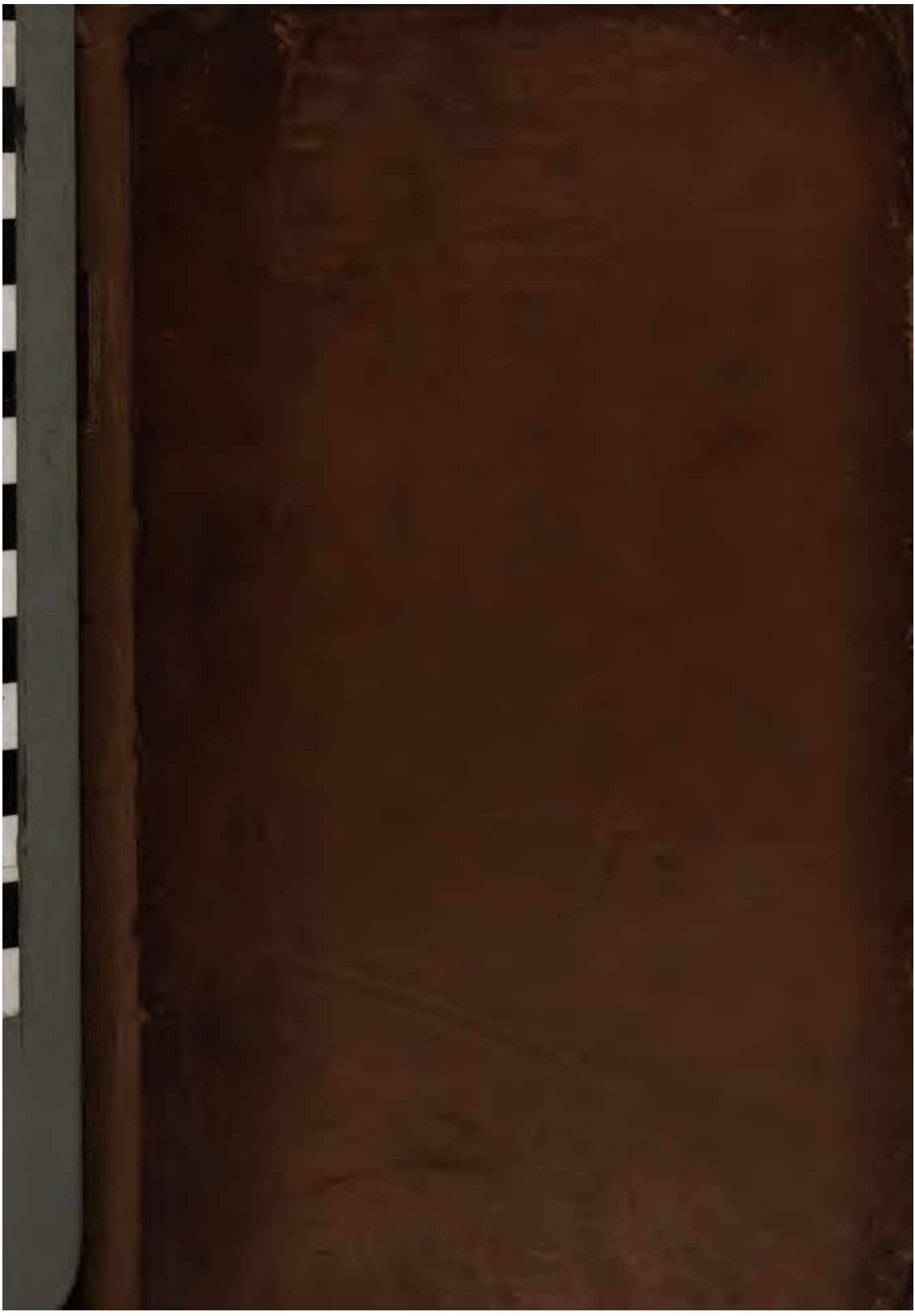
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



e. 29

E. BIBL. RADCL.

1901 C. 192

600030409M

SELECT DISSERTATIONS

FROM THE

Amœnitates Academicæ.

SELECT DISSERTATIONS

FROM THE

Amœnitates Academicæ,

A SUPPLEMENT TO

MR. STILLINGFLEET'S TRACTS

RELATING TO

NATURAL HISTORY.

TRANSLATED BY THE

Rev. *F. J. BRAND*, M. A.

IN TWO VOLUMES.

VOLUME I.

LONDON:

Sold by G. ROBINSON, Bookſeller, in Paternoſter-Row, and J. ROBSON, in New Bond-ſtreet.

M,DCC,LXXXI.

H. 23

PREFACE.

THE reputation of ſuperiority in the different branches of knowledge is not at preſent the excluſive poſſeſſion of a ſingle people; the different ſtates of modern Europe ſeem to ſhare it among them, with nearly the ſame equality that they have divided political power. The mathematical philoſophy of England has been embraced by the whole literary world, in ſome of the fine arts Italy has given laws to the general taſte, and in Natural Hiſtory the Swediſh ſchool has attained the ſame diſtinction and preeminence.

The collection of eſſays publiſhed under the title of the Amœnitates Academicæ are the works of the moſt capital diſciples

diſciples of this ſchool, compoſed under the direction of its illuſtrious founder Linnæus, and very frequently dictated by him.

A number of theſe were tranſlated by the late Mr. Stillingfleet, under the title of Miſcellaneous tracts relating to Natural Hiſtory: this work was enlarged by ſome valuable additions of his own, particularly his obſervations upon Engliſh graſſes. The limits impoſed upon him by his plan excluded ſeveral curious pieces of Zoology, and other uſeful ſubjects, and an aditional Volume has come out ſince his publication: theſe have furniſhed the materials of the preſent work, which may be conſidered as a ſupplement to his tracts; and I ſhall be happy if it do not diſgrace the very able performance which gave birth to it.

The ſcarcity of the firſt volumes of the original work, which are now out of print, ſeems to point out the neceſſity of ſome attempt

attempt of this kind; as Natural Hiſtory is at preſent a very general ſtudy, and has been conſiderably indebted to the diligence and aſſiduity of many perſons to whom theſe eſſays are not acceſſible in the language in which they are written; the intereſt of the ſcience itſelf ſeems to point out that they ſhould be informed of what remains to this preſent among its deſiderata, and in what branches it has been already perfected: both to furniſh them with objects to direct their future reſearches to, and that they ſhould not fling away their application in purſuits which in the end muſt terminate in the diſappointment of finding their diſcoveries anticipated.

In ſelecting the eſſays I have been favoured with the aſſiſtance of Dr. Solander, by whoſe advice I conſiderably enlarged my firſt deſign.

Upon

Upon a compariſon of the tranſlation with the originals ſome omiſſions will be diſcovered, and as theſe are not always noted at the bottom of the page, it is neceſſary to give ſome account of them here. —— Moſt of the writers of the Amœnitates have thought a very florid Introduction neceſſary to the plain details of Natural Hiſtory: the eſtabliſhed form of an Academical theſis may impoſe a kind of neceſſity upon the ſpeaker to give into ſuch a practice; but as the ſubject is the ſame in moſt of them, a ſketch of the outlines of the three natural kingdoms, and the admiration which a total view of them muſt imprint upon the mind of man, I have ſometimes avoided the monotony of ſo undiverſified a Preface; and preſerved only ſuch entire as were diſtinguiſhed by a particular merit: and the like reaſon has induced me to retain and connect ſome detached parts of others.

The

The ſame matter is likewiſe frequently repeated in the writings of different perſons upon ſubjects either ſimilar or nearly related; where the connection of the whole would permit, theſe repetitions are omitted, and where it would not they will be found ſometimes abridged.

In this tranſlation likewiſe ſome comparative deſcriptions and collections of obſervations are digeſted into the form of tables: the uſe of ſuch compilations is either to be occaſionally conſulted, or to prove ſome general concluſion by induction; and the readineſs with which any number of ſuch articles diſpoſed in a table ſtrike the eye, renders it fitteſt for that purpoſe; and they ſerve only to perplex or elude the attention, and embarraſs the text when they are incorporated with it.

The Latin names of animals and vegetables are generally retained in this work, and their Engliſh names given at the bottom of the page*. When Natural Hiſtory comes to be cultivated to any degree in a country, the number of new diſcoveries at home ſoon demonſtrate the poverty of the language; and it muſt totally fail in a general attempt to name the variety of ſubjects flowing in on every ſide from abroad. A language has alſo at that period other neceſſary imperfections, ariſing from the want of ſcientific knowledge in the preceding times in which it was formed: it gives different denominations to ſome natural ſpecies connected by the neareſt affinity, and the ſame generical name to thoſe which have no relation to each other: thus we find the

* The names of our native animals and inſects are taken from Berkenhout's outlines of the Natural Hiſtory of Great Britain, volume the firſt. But for ſuch as have no names given them in Engliſh, I have quoted his work, the number of the page, and that of the given ſpecies in its genus.---The letters B. or Berk. are marks of reference to this author.

the name of Sampire given to the Salicornia europœa, Echinophora ſpinoſa, Crithmum maritimum and the Inula crithmoides. The only way both of getting rid of this confuſion, and preſerving the language of Natural Hiſtory from becoming a teſſelated patchwork of Greek, Latin and Engliſh, is to purſue the method which Mr. Stillingfleet has practiſed in naming the graſſes, but till this be done our firſt care ought to be to avoid perpetuating the old confuſion of the ſubject.

At the end of the diſſertation upon the native ſtations of plants there follows in the original a liſt of Swediſh plants ranged according to their ſtations. I have ſubſtituted the Engliſh plants in its place, divided according to their time of flowering, and ſubdivided according to their ſtations: this does not apply ſo well to the ſubject of the eſſay, but this order has its uſe as giving a better form of a

general Engliſh herbation; and as it was drawn up for my own private uſe ſome years ſince, I did not think of giving myſelf the trouble of copying out the whole in a new order: all the alteration I have made in it is to accommodate it to the improved edition of Mr. Hudſon's Flora.

The order in which theſe pieces ſucceed each other in the original is not preſerved in the tranſlation: thoſe relating to the ſame or collateral ſubjects being placed immediately after each other in the order of time in which they were written; as they thus exhibit a total view of the whole, the hiſtory of the ſucceſſive additions and corrections made to a diſcovery, and the progreſſion of conſequences deduced from it.

TABLE of CONTENTS.

VOL. I.

I. General Dissertations.

1 *On the Uſe of Natural Hiſtory, by Matthew Aphonin, a Nobleman of Moſcow* —— *page* 1.

2 *On the Increaſe of the habitable Earth, by Linnæus* - - *p.* 71.

3 *On the Police of Nature, by Chriſt. Daniel Wilche* - - *p.* 129.

II. Zoological Dissertations.

4 *On the Rhendeer, by Charles Frederic Hoffberg, of Stockholm* - *p.* 167.

On

5 *On the Migration of Birds, by Charles Daniel Ekmarck, of Oſtrogothland, p.* 215.
6 *On the Bite of Serpents, by John Guſtavus Acrell - - p.* 265.
7 *On Inſects, oration, by Linnæus, p.* 309.
8 *The Flora of Inſects, by Jonas Guſtavus Forſſahl - - - p.* 345.
9 *On Noxious Inſects, by Michael A. Baeckner - - - p.* 369.
10 *Miracula Inſectorum, by Emanuel Avelin, - - - p.* 413.
11 *On the Silk worm, by John Lyman, p.* 437.
12 *On Corals, by Henry Fougt, p.* 457.

ERRATA.

Page 1. and 71, for Amæn. r. Amœn.—p. 45, line 7, yet dele—p. 127, l. 1, mountains, r. mountain—p. 145, l. 6, REAMUR, r. REAUMUR—p. 167, l. 8, extreme, r. extremely—p. 170, 177, 178, deſarts, r. deſerts—p. 191, l. 15, the, r. that the—p. 212, l. 6, dele again—p. 228, note, igration, r. migration—p. 232, l. 18, principelly, r. chiefly—p. 245, l. 4, deſtroy, r. deſtroy the—p. 289, l. 17, affirmed, r. declared—p. 289, l. 18, declare, r. confirm—p. 293, l. 1, Diſpaſas, r. Dipſas—p. 312, r. 11, dele the—p. 315, l. 13, of, r. of that of—p. 323, l. 7, produces, r. produce—p. 327, l. 13, Deſmeſtes, r. Dermeſtes—p. 329, l. 20, loſes, r. loſe—p. 343, note, Aſtucus gumarus, r. Aſlacus gammarus—p. 352, l. 3, purſe, r. purpoſe—p. 361, l. 1, lucurious, r. curious—p. 366, l. 31, Almes, r. Alnus—p. 375, l. 15, greater. r. great—p. 376, l. 21, fell, r. falls—p. 377, l. 10, enquiries, r. inquiries—p. 383, l. 16, herculearia, r. herculeana—p. 391, l. 12, to, r. to thoſe of—p. 393, l. 16, Acarius, r. Acarus—p. 395, l. 17, deſtroy r. deſtroys—p. 420, l. 2, ſcull, r. ſkull.

GENERAL DISSERTATIONS.

DISSERTATION I.

On the Uſe of Natural Hiſtory, by Matthew Aphonin, a Nobleman of Moſcow.

Amæn. Acad. t. 7, 409.

SUMMARY.

*Preſervation of the ſpecies of animals——their mode of ſubſiſtence——on labour——*OECONOMICS *what——Tropical countries firſt inhabited——Migrations into colder latitudes give riſe to agriculture——Vegetables proper for human food, few——*

few——Neceſſity of the knowledge of the ſpecies of the three natural kingdoms ——this ſtudy defended——Oeconomics when firſt made a part of natural hiſtory.

Uſe of BOTANY*——Native ſtations of plants——Zizania aquatica——Quantity of barley deſtroyed in Sweden by the fly called the Frit——The raiſing of plants before unknown reduced to fixed principles ——Examples, the Rubus Arcticus—— Muſa paradiſiaca——On fruit trees ——deſtroyed by caterpillars——remedy ——Hops deſtroyed by a honey-dew—— remedy——Of flax, its ſoil——Tea plant, probability of raiſing it in Europe ——Spices in America, and the iſlands ——Coffee——On raiſing young trees ——Plants for fences——Goodneſs of the alopecurus pratenſis——the trifolium hybridum——Medicinal plants——noxious plants——Uſes of the Kalendar of Flora——Of the Swediſh pan.*

On CATTLE——*plants wholeſome and noxious to them*——*deſtruction of noxious beaſts.*

BIRDS, *their uſes*——*modes of rearing and taking.*

REPTILES, *modes of deſtroying*

FISH, *modes and places of taking them.*

INSECTS, *modes of deſtroying ſome ſpecies*——*Of the cimicifuga fatida*——*the coccineal*——*the bee*——*the ſilk-worm*——*Concluſion.*

THE Divine Being has ornamented the world with ſo many proofs of his wiſdom, that it is impoſſible to enumerate them——But one law which he has impoſed upon the animal creation demands our particular attention, which ordains that every animal, propagating its

ſpecies, the number of kinds ſhould be preſerved undiminiſhed, each parent living as it were again in its offspring: a law which equally includes man with the reſt of living beings.

Although the great architect of the univerſe has created an infinite variety of kinds of plants, and innumerable animals comprehended under the claſſes of the mammalia, the birds, amphibious animals, fiſh, inſects and worms; yet he has ſo ordered that every ſpecies of plant and animal is ſupported by the aliment allotted to it by his own poſitive conſtitution; for want of which it muſt directly be loſt; for not only every genus, but every ſpecies has its natural œconomics, and its proper productions aſſigned to it by nature; leaſt the one ſhould moleſt and deprive the other of its food, and thus introduce confuſion in the eſtabliſhed order of things. Therefore every one is circumſcribed, and that under capital penalties,

nalties, within its own proper limits.—Nature has placed man the laſt of her works, as the prince of her creation, and ordained every thing either mediately or immediately to be ſubſervient to his uſe: Nor (to ſpeak with Pliny) can any one juſtly reproach her with being only a ſtep-mother to man, becauſe ſhe does not produce ſpontaneouſly every thing neceſſary for him: the Divine Being has impoſed a neceſſity of labour and induſtry upon him, that by tracing his footſteps, and thus acquiring the knowledge of created things; he might form an idea of their author, at the ſame time that he ſought out and acquired what was neceſſary for his daily food, and thoſe things which were calculated to ſupply his other wants.

SECTION II.

The different kinds of plants and animals have not one common native country;

try; ſome inhabit the torrid, ſome the frigid, or temperate zones; others are found in alpine of marſhy countries, but man is a native of every climate;—yet his original ſeat ſeems to have been between the tropics; both becauſe in the ſtate of nature he is naked, and that he is able in thoſe regions to ſupport himſelf with very little labour; the vegetable creation preſerving a perpetual verdure, which ſupplies him the whole year with fruits, flowers, herbage, and roots; and there likewiſe on account of the conſtant heat, animal food is diſagreeable to him. But as this region could not ſupport the total multitude of mankind, they were obliged to deſert the tropics, and wander over the whole earth in ſearch of ſubſiſtence; which, where it is found ſcantily, evidently calls for more labour and diligence to acquire it. By this means daily experience teaches us, that he can live very commodiouſly by the aſſiſtance of the arts of cultivation, which we call

OECONO-

OECONOMICS.—The ſcience which teaches us to convert natural things to the uſes of mankind, I call PRIVATE OECONOMICS.---Theſe natural things are of three ſeperate kinds, being derived from the three natural kingdoms, the foſſil, the vegetable, and the animal: what man ſupplies himſelf with from hence is either for his food, which is his firſt object, or his raiment, or the different conveniences of houſes, utenſils, and commerce.

SECTION III.

I think no one will deny that man, in the firſt ages, might live moſt commodiouſly under the tropical regions; where the moſt grateful food can be obtained without any difficulty, and he has occaſion for exerciſing very few of the arts of life.—As it is evident that the original food deſtined by nature for man, the fruit of vegetables, was not even in that region to be found every where in ſufficient plenty,

plenty, he was obliged to plant trees of the palm tribe, as the phœnix*, the cocos†, the cyaca‡, and others. When mankind had migrated beyond the bounds of their original ſeat, to thoſe countries where winter and ſummer alternately ſucceed each other, the ſpontaneous fruits of the earth were not ſufficient for their ſupport, and corn became a neceſſary reſource to them.—But this dry farinaceous diet being taken in too great quantities, produced the moſt fatal bad habits of body: neceſſity taught them, therefore, to attenuate this food by fermentation and baking, and thus to render it more wholeſome. But the importunities of appetite were not to be ſatisfied with a ſeed diet alone; men learned a promiſcuous uſe of animal and vegetable food, and thus have been able to ſupport life with comfort, beyond the limits of a hot climate.

SEC-

* Date-tree. † Cocoa-tree. ‡ Sago-tree.

SECTION IV.

By the neglect of this neceſſary ſcience of œconomics, the race of man would become miſerable, and the countries beyond the limits of the tropics ſcarcely habitable.—Let us form to ourſelves an image of our own northern countries in an uncultivated ſtate; covered over with dark immenſe foreſts of pine, or wild heaths, with no vegetable but the Erica*, and other ſimilar plants: Can any fate be conceived more hard than that of a man ſhip-wrecked upon the coaſt of ſuch a country? ſcarcely able, eſpecially in winter, to find in a whole diſtrict enough food to ſupport the life of a ſingle individual. Lord Anſon's voyage gives us more than one example of ſuch a miſerable lot; there we ſee ſailors caſt aſhore in different parts of South America, who either periſhed, or according to the relation, were reduced to the extremity of

* Heath.

famine, in thoſe extenſive tracts which if reduced into cultivation could ſupport millions of men.—One wonders in theſe accounts, that among the innumerable ſpecies of plants which are diſcovered in thoſe deſarts, ſo few are found adapted to the ſupport of human life, but moſtly ſuch as are proper for cattle and other animals: for there is no plant hitherto diſcovered but what ſerves for food to ſome animal. Hence we are almoſt induced to believe, that Providence has been more beneficent to the animal creation than to man: for if he ſhould make an attempt to convert thoſe things to his own uſe, which are not his property, and aſſigned by nature for his ſupport, he would die by them as infallibly as by poiſon.---But a nearer and more attentive view of nature teaches us the truth of what is affirmed in the holy ſcripture, that every thing was made for the uſe and happineſs of man; if not immediately, yet mediately: and that thoſe things

which

which at firſt appear uſeleſs, are rendered uſeful by labour guided by experience.

CHAPTER II.

SECTION I.

THOSE whoſe buſineſs lies in the œconomic arts, collect from the treaſures of nature whatever they are abſolutely in need of, or can procure any accommodation to them; and from that copious repoſitory we muſt ſelect whatever is mediately or immediately uſeful to mankind. That this choice may be rightly made, we muſt have an accurate enumeration of thoſe things which are to be ſelected, that they may be ſo well known and diſtinguiſhed as not to be liable to be miſtaken for others. To give ſolidity to this knowledge, it muſt be

ſought for in that ſcience which is called the Scicnce of Nature; for if ſome individuals did not cultivate it to a certain degree of perfection, it would induce innumerable errors into the world. Let us firſt, therefore, take a review of what this ſcience dictates to us.

SECTION II.

The ſcience of nature, or the knowledge of natural bodies ccmprehends Zoology, Botany, and Lithology; and teaches, firſt, by the moſt eaſy method to diſtinguiſh every individual of thoſe three kingdoms by certain and ſpecific marks; to aſſign proper names to each, which may be univerſally underſtood by thoſe to whom this ſcience is familiar; and then, after a perfect enumeration of all their ſpecies, to diſcover their qualities, powers, diſtinct conditions and properties.

SEC-

SECTION III.

This ſcience, the moſt extenſive of all others, has been cultivated by the labours of innumerable obſervers; yet though their reſearches have diſcovered many uſeful things, the ſubject is not yet exhauſted: Nature has reſerved many diſcoveries for poſterity, that men of every age may trace new marks of the divine wiſdom, and their ſentiments of piety and gratitude go on perpetually increaſing.

SECTION IV.

I readily grant that the treaſures of nature have hitherto ſupplied an inexhauſted occupation to the Natural Philoſopher, in deſcribing and arranging their ſpecies.--- This has been the ground of that judgement ſometimes paſſed upon this ſcience by an undiſcerning and vulgar prejudice, that

that it is rather matter of curioſity than uſe, or that it is of ſervice only to the phyſician, as he derives his medicines from it.

SECTION V.

But let us admit that this accurate ſcrutiny of nature is matter of curioſity only; ---it is certainly a curioſity worthy of man, and which holds a place in his firſt and moſt ſacred duties.----Thoſe who carry their enquiries into the moſt conſecrated receſſes of nature, muſt be penetrated by a more felt admiration of the wiſdom and goodneſs of God;----if we conſider the nature of man and external things, we ſhall diſcover that the final cauſe of his exiſtence was the contemplation of thoſe objects he ſees around him, that he might trace the footſteps of the divine power and goodneſs, and with the moſt aſſiduous contemplation note, examine, and admire them. Elſe, for what

what end has the Supreme Being raiſed him with ſo many excellent endowments above the animal creation, whoſe dignity is loſt in him who lives unknowing of himſelf, and negligent of his Creator?

SECTION VI.

In this age Natural Hiſtory firſt began to put on an appearance of practical application and utility:----this we owe to the works of Ray; who, in his Hiſtory of Plants, publiſhed at the beginning of the preſent century, added their œconomical uſes to his account of many ſpecies; but his collections of this kind were extremely narrow and confined. Moſt of what has been done upon this ſubject we owe to the illuſtrious Linnæus; who has caſt ſo many new lights upon the abſtract part of this ſcience, and directed his labours ſo, that they all tend to this end, marked out by the univerſal wiſh of mankind.

SEC-

SECTION VII.

It is to be wiſhed that ſome perſon converſant in this ſtudy, would arrange and digeſt into a regular and ſyſtematic order every thing upon this ſubject which he has given us, or has been publiſhed under his direction and auſpices, which now lies ſcattered up and down in different eſſays and publications.----But I return from this digreſſion. My preſent buſineſs is to demonſtrate the neceſſity and uſe of natural hiſtory in private œconomics, and that the latter cannot ſubſiſt without the former: to execute which plan, I ſhall run through all its parts ſeparately.

CHAPTER III.

SECTION I.

NO one will attempt to deny that agriculture is deſervedly held as the firſt in rank among the arts which enable us to ſupport life, by thoſe nations who are not included between the tropics---- it is unneceſſary to go into an extenſive proof of its utility, its antiquity, and the eſteem in which it has been held by all civilized countries.

SECTION II.

It is a well-known fact that every ſituation is not adapted to every plant; nature has aſſigned to each its proper ſtation, that is its native ſoil, where it is ſuſtained agreeably to its quality, and

 therefore

therefore raiſed with greater profit and ſucceſs. Thus the different ſpecies of grain which we call the Cerealia*, require each a different ſoil; wheat thriving beſt in clay, barley in pure vegetable earth, and rye in ſand. Yet all plants derive their nouriſhment from that fine line, impalpable vegetable earth, to which the name Humus is particularly aſſigned; and the ſoil muſt be thoroughly ſtirred, mixed, and watered, that this may be conveyed to their roots. Where this food of plants is not naturally found in a ſoil in ſufficient plenty, a manure becomes neceſſary; the ingredients of which muſt be compounded in ſuch proportion, as agrees beſt with the quality and nature of the plant to be raiſed: for it is univerſally known, that dung ſupplies an earth whoſe particles are extremely fine, which is very nutritious to many plants. But as all the ſpecies of grain which we cultivate with ſo much attention are foreigners,

* Bread corn.

reigners, and the Creator has allotted to every plant its ſtation, in which it muſt neceſſarily be planted to flouriſh with the greateſt vigour; a prudent attention to the native ſtations of each becomes neceſſary, if we be deſirous of improving our land to obtain the greateſt crops poſſible.

SECTION III. *omitted.*

SECTION IV.

It is impoſſible to be upon the ſubject of agriculture without mentioning the Zizania aquatica*, a graſs which is produced naturally upon the banks of the lakes of North America; it grows like rice in water, its grain is larger, and hardly yields to it in flavour: the native Americans ſeek for it with avidity for

* Jamaica Zizania.

the food of themſelves and families. If its ſeeds could be obtained and ſown in thoſe places which at preſent produce nothing but reeds, thouſand of additional inhabitants might be ſuſtained by this food; an improvement in œconomics of which no one but a Botaniſt could be the author.—When the celebrated Kalm embarked for his voyage to theſe countries, our illuſtrious Preſident deſired him either to ſend him ſome of thoſe ſeeds over, or bring them back with him; he brought ſome with him into Sweden, but they were ſo withered that they would not germinate; by which misfortune it ſtill remains among the firſt objects of our wiſhes to obtain them*.

SECTION V.

The devaſtions made in our barley by the fly called, in Sweden, the Frit†, is incre-

* Some ſeed has ſince been received in Sweden.

† The name of this inſect is the Muſca hordei; it is mentioned in Backner's Hiſtory of Noxious Inſects.

incredible. By a computation of our preſident in the Acta Stockholmienſia, we find it conſumes every tenth or twentieth grain, amounting in each year to the quantity of 100,000 Swediſh tons: the ſource of this loſs had been before quite unobſerved, and no one but a naturaliſt could have detected it: the remedy of this evil remains yet unknown, and muſt do ſo until the natural hiſtory of inſects ſhall be perfected.

CHAPTER IV.

SECTION I.

OUR gardens have lately been enriched with many new diſcoveries, ſo that the Muſa* and Anana† are no longer ſtrangers in thoſe of the curious,

* Plaintain-tree. † Pine-apple.

curious, where their fruits are produced in the greateſt perfection and flavour. ----Many believed that experience was the only ground of this art, until Linnæus demonſtrated firſt in the Acta Stockholmenſia, and his diſſertation de Horticultura Academica, that it was founded on the principles of natural philoſophy; and that a gardener who undertakes to raiſe a given plant, may, by an attention to its qualities, determine what ſoil and what degree of heat it demands, and ſow its ſeeds without fear of diſappointment. Thus we may be plentifully ſupplied with the Siſarum and Lathyrus tuberoſus* which are now very ſcarce, if our gardeners will attend to their natural ſtations; by the neglect of this care, the Artemiſia dracunculus being indifferently planted in any ſoil, frequently fails with us. If the botanical gardeners among my countrymen knew that its ſtation was flooded,

* Tuberoſe Chickling vetch.

flooded in winter, they would have planted it in a proper place, where without doubt it would have conſtantly come to perfection.

SECTION II.

Therefore, as the raiſing of plants is founded upon the knowledge of their native ſoils, thoſe who are deſirous of adorning their gardens with exotic trees ought to be well verſed in natural hiſtory; that they may be acquainted with their native country, earth, and gemmation; and learn from thence what tree will thrive in this place, what in that; and not ſee great trouble and great expence terminate in diſappointment.

SECTION III.

If the inhabitants of Sweden had been acquainted with the beautiful trees which

our

our provinces of Siberia and Tartary produce, they might have gotten from thence many elegant ornaments for their gardens; as the Morus tartaricus*, the Ulmus pumila†, the Prunus Siberica, the Spiræa ſorbifolia‡, the Pinus cembra‖, and many more, which would flouriſh with as much luxuriancy beneath a Swediſh ſky, as the Robinia caragana§.—The Rubus arcticus¶, is a native of the polar circle, which excells all the fruits of Europe in ſweetneſs and flavour, and cannot be purchaſed in quantities at any price in Upſal or Peterſberg: Every body was unacquainted with the manner of raiſing this vegetable until Linnæus lately publiſhed it in the Acta Stockolmienſia.—The ſtation of the plant led him to this diſcovery; it naturally grows in a ſoil which remains frozen until the end

* Tatarian mulberry.
† Dwarf Siberian elm.
‡ Service-leaved Sp.
‖ Cembro pine.
§ Caragana.
¶ Siberian rubus.

end of the month of Frondeſcence, which he ſhews to be eaſily imitated by art.

SECTION IV.

It has been a general ſubject of wonder to the Botaniſts, that the Muſa paradiſiaca* is the only plant abſolutely deſtitute of ſeed, and ſolely multiplied by the roots: our preſident demonſtrated (in the 6th vol. of the Amænitates) as that it is a hybrid plant, and from the obſervations he has there laid down, it is evident that it can never produce ſeed, the Antheræ being without male duſt. The curious cultivators of this plant had even been unable to produce fruit from it, until he firſt ſucceeded by a mode grounded on natural principles: this he performed in Holland, and a full account of it is given in the Muſa Cliffortiana.

* Plain-tree.

SECTION V.

The various modes of propagating trees are founded on the Prolepſis of plants, one of the moſt profound ſubjects in botany: to this we refer inſition, inoculation, and all the different manners of grafting.——Many errors are generally current among our countrymen upon this ſubject: as that by grafting a good fruit upon a ſtock of inferior properties, it will degenerate; and that the plants raiſed from the ſeed of ſuch fruit will reſemble the ſtock, and not the plant ingrafted:—theſe errors have their ſource in an ignorance of the doctrine of the prolepſis.——The grafting of the apple and the pear upon wild ſtocks is neceſſary, that the root from whence they derive their nutriment may be able to bear the ſeverity of the winter, and be preſerved from the injuries they frequently receive

receive from the Mus terreſtris*; whoſe ravages have frequently been miſtaken for thoſe of the mole, by perſons unacquainted with natural hiſtory.

SECTION VI.

As we are now upon the ſubject of fruit trees, it is impoſſible that the damages they ſo often receive from the Caterpillars ſhould not occur to our recollection; their leaves, flowers, and fruits, are every year deſtroyed by them: no remedy can be expected to this, unleſs from perſons verſed in their natural hiſtory and metamorphoſes; ſuch a one knows that their eggs are generally depoſited in the Autumn, that they breathe by lateral pores, and conſequently are deſtroyed by thoſe perforations being cloſed by any oily ſubſtance, and that they are devoured by the Carabi†:——

* Short-tailed Field mouſe.

† Beetle, Berk. 109.

Some have endeavoured to deſtroy them by ſmoak, and being ignorant of its effect upon plants, have thus made uſe of a remedy more deſtructive than the diſeaſe. The beſt expedient that can be employed againſt them is, upon the approach of Spring to fold a cloth, dipped in the rancid oil of the Sea calf, round the top of the trunk of the tree.

SECTION VII.

Many plantations which are objects of agriculture, ſuffer in various ways from an ignorance in that ſcience whoſe utility we are treating of: the cultivation of hops, which is now ſo very general, is not in many places equally ſucceſsful; immenſe hop grounds will frequently for twenty years ſucceſſively, appear with the moſt promiſing verdure, yet produce nothing:----when the fructification in an early ſtate contracts a mouldineſs, it withers, and is deſtroyed;-----the farmer imputes

imputes this to a honey-dew, which he thinks falls from the air; the Zoologiſt obſerves innumerable Aphides* hidden in the upper leaves, who eject this liquid; but the hop itſelf muſt firſt languiſh, and be in a ſickly ſtate before it be infeſted with theſe inſects; and into this ſituation it is reduced by the Caterpillar of the Phalæna humuli† which feeds upon its roots. This is a circumſtance of which the cultivators of this vegetable are univerſally ignorant; although ſome of them have diſcovered, that a ſound hop will be infected by planting a ſickly one near it, when they tranſplant the roots from a hop ground that is thus attacked, into one perfectly healthy.--- The Botaniſt obſerves, that the hop grows naturally among heaps of ſtone and fallen fragments of rocks, and that there it is never damaged by the honey-dew;---the reaſon of which is, that the caterpillar of the Phalæna humuli cannot, in ſuch a ſoil,

* Leaf-louſe. † Otter moth.

ſoil, penetrate to its roots, and therefore he who is ſolicitous of ſucceeding with the hop, muſt cover the ground with ſtones.

SECTION VIII.

The flax is a native of Egypt, and grows in thoſe parts which are flooded by the Nile; the Botaniſt from this is able to determine, that earth from a muddy marſh is the beſt dreſſing he can ſpread over this plant.

In a word, all cultivation of exotic plants muſt be directed by their native ſtations: as every plant is the ſpontaneous production of ſome one ſoil, the knowledge of that, which muſt be derived from Botany, will enable any perſon to cultivate thoſe plants with ſucceſs, which he muſt otherwiſe fail in.

SECTION III.

It has been an object of wonder that the tea-plant has not been introduced into Europe,---for which ſuch immenſe quantities of ſpecie are annually remitted to China.----The ſeed is eaſily procured there, and has been often brought over hither, and ſown: a number of attempts have been made to obtain the ſhrub itſelf, but every endeavour has been fruſtrated, and we muſt look for the cauſe of our want of ſucceſs in the plant itſelf *.----This has been overcome by the moſt conſummate Botaniſt of his age; and we may now promiſe ourſelves, that the Tea plant will in be in a little time as common in Europe as the Syringa, a native of the ſame country.

CHAP-

* See Note (*A*) at the end of this Eſſay.

CHAPTER V.

SECTION I.

IF a proper attention had been paid to vegetable productions, the Cinnamon, Clove, and other ſpices, would not at this day been the monopoly of a ſingle nation*. Theſe plants may be as well raiſed in the Weſt Indies as the Coffee is at this time, for which we were formerly tributaries to Arabia, and ſhould have ſtill continued ſo, if Vincentius had never been appointed to the direction of the botanical garden of Amſterdam.----It is an object of wonder to us, that the Cinnamon, which has lately been diſcovered in Martinico, is not yet an article of its commerce with Europe; eſpecially as it is ſaid to equal the quality of that of the Eaſt Indies. The Swedes every year import

* See Note (*B*) at the end of this Eſſay.

port the Rubia tinctoria*, although the province of Scania is particularly adapted to the culture of it: they have endeavoured unſucceſsfully in many places to ſow the Napus from which oil is extracted; but the experiment has not been ſo much as attempted in Eaſt Gothland, though it is there a ſpontaneous plant, and even abounds ſo in every field as to be a troubleſome weed.

SECTION II.

The raiſing of woods is an object of great magnitude as they have been too much deſtroyed in many parts of Europe: in this our farmers in general are ignorant, not knowing the proper ſoil which the ſeveral ſpecies of timber affect, nor how to protect the young plants from the ſpring froſts; they not only omit the uſe of moſs upon this occaſion, but even

* Madder.

very ſolicitouſly root it up; being deceived by an idle prejudice that it naturally excludes all other plants.—Yet they might derive great utility from the moſſes, by attending to the purpoſe of nature in the production of theſe vegetables; by their covering the ſoil, they protect the roots of plants under it from the burning heat of ſummers, and the exceſſive froſts of the contrary ſeaſons, and hinder their being buried in the duſt the wind bears with it.

SECTION III.

Hedges which are ſo ornamental and commodious in the ſouth of Europe, might alſo be planted with advantage in our northern latitudes: but as every individual country has only a limited number of native ſhrubs, of which the common people, guided by no ſcientific principle, do not know the cultivation, many parts are yet without this neceſſary pro-

protection. Many different ſhrubs are proper for this purpoſe, though we cannot form them in our northern climate of the Agave Americana*, as in Portugal, or the Bromelia caratas†, which in Jamaica ſerves its inhabitants for wooden fences, and protects their cattle from the heat: The Cactus‡ and Euphorbia§ have even ſerved the ſettlers in Euſtatia for a paliſade againſt a ſudden hoſtile attack; this we relate upon the credit of Jacquin. Yet we are not deſtitute of plants of the like nature, as the Oxyacantha‖, Berberis¶, Prunus**, Rubus§§, and many others, of which excellent hedges might be made, if regard were had to the nature of the ſoil in the choice of our ſhrubs.

* Great Ag.
† Wild pine apple.
‡ Melon-thiſtle.
§ Euphorbia.
‖ White thorn.
¶ Berberis.
** Black-thorn.
§§ Briar.

SECTION IV. *omitted.*

SECTION V.

I ſhall not go into a detail of the cultivation which might be introduced into Alpine countries,——but barely content myſelf with recommending to ſuch of my readers as are deſirous of obtaining any real knowledge upon this ſubject (if this Diſſertation be honoured with ſuch) the excellent obſervations contained in a paper upon it in the Acta Stockholmienſia, founded upon the beſt principles of botanical knowledge, and from which the beſt inſtructed cannot fail of receiving new informations. May my country at ſome near period ſee their utility, and embrace them.

SECTION VI.

Thoſe low meadows which give ſuch abundant crops of hay, are frequently ruined by the Caterpillar of the Phalæna calamitoſa: to this evil there is no remedy; it is impoſſible for the farmer to get together a number of crows, the natural enemies of this deſtroyer; the Botaniſt therefore will teach him to ſow theſe meadows with the Alopecurus pratenſis*, which always eſcapes untouched, and ſupplies an equal quantity of fodder.

SECTION VII.

Thoſe who have ſeen the beautiful fields of England and France covered with the Lucerne and Saintfoin, upon their return have endeavoured to introduce the cultivation of thoſe plants among us

* Meadow fox-tail graſs.

us. But as they have been ignorant of their natural ſtations, their attempts have been fruſtrated---while the Trifolium hybridum*, a native of their own country, has eſcaped their attention, which is much ſuperior to the two former.

SECTION VIII.

In the ſouth of Europe, medicinal plants are cultivated with great care, and enter for part of the articles of its commerce with theſe northern kingdoms; whoever ſhould attempt to naturalize them here, ought to be an experienced Botaniſt leſt he loſe his labour; but to ſuch a one the attempt will be no way difficult.

SECTION IX.

There are many poiſonous plants, but which are only ſo to certain animals, as the

* Hybrid white trefoil.

the Cicuta*, the Aconitum †, and others, from which the farmer will be in danger of loſing his cattle if he be ignorant of their properties: the Anemone nemoroſa‡ kills oxen and ſheep, if ſuch beaſts as have not learned the properties of this plant be turned into places where it abounds.

SECTION X.

From what has been ſaid, the utility of Natural Hiſtory to mankind in general is ſufficiently evident. Were I to purſue this ſubject through all thoſe points to which an account of the advantages which have been derived from a ſcientific application of it would lead me, the pages of this Eſſay would grow into volumes.-----I ſhall barely mention the Kalendar of Flora, which was firſt propoſed

* Water hemlock. † Aconite.
‡ Wood anemone.

poſed by our Preſident, and is of ſuch uſe in the ſcience of œconomics, that if it had received its ultimate improvements, the moſt illiterate countryman would acknowledge the benefit and neceſſity of our reſearches; as by this means he would become acquainted with the proper ſeaſons of all kinds of work during the greateſt part of the year.----By this we predict the arrival of birds of paſſage, and the fiſherman knows when he is to expect fiſh of certain ſpecies near the ſhore:----hence we gather the time of ſowing and harveſt; the flowers of plants even indicate whether the day will be fair or rainy, which is a knowledge of the greateſt conſequence to the farmer, when he is getting in the fruits of the earth.

SECTION XI.

I do not ſpeak of paſtures as indifferently furniſhing food to all animals, but only obſerve that all are not equally proper

per and grateful to every ſpecies: In ſome, ſheep ſucceed beſt, in others, horſes, in others, neat cattle and ſwine.——And therefore I ſhould cenſure the labours of the herdſman, who neglects to ſearch in the Swediſh Pan, what plants are the beſt food for his flocks and herds; and learn from thence to feed off every part of his meadows, which produces different herbs, with its proper ſtock. There is a deciſive obſervation of our Preſident, Linnæus, upon this ſubject, in his Tour in Scania; he there mentions a certain iſland which abounded with the Agroſtis arundinacea*; the goats which were turned to feed upon it periſhed by famine, but the horſes which followed them grew fat.—The calf ſhrinks and declines among the moſt luxuriant Ulmariæ†, the goat thrives no where better; and even the poiſonous Cicuta‡ is a banquet to him. Nothing is either univerſally wholeſome, or the

* Reed bent-graſs. † Meadow ſweet.
‡ Water hemlock.

contrary, nothing ſimply poiſonous, but only comparatively. And thus every thing contributes to the utility of man, either mediately or immediately.

O fortunatos nimium, ſua ſi bona norint Agricolas. VIRG.

Thou happy peaſant! love thy calm retreat,
Know thine own good, too fortunately great.

PART II.

CHAPTER I.

SECTION I.

HE who would rear flocks and herds (a ſecond reſource which provides aliment for man) well, and with profit, muſt alſo be acquainted with thoſe parts of Natural Hiſtory connected with them; both to enable him to increaſe thoſe uſeful animals, and to guard them from diſtempers.

Thoſe animals of the 4th order of beaſts called the Pecora, are what I here

chiefly conſider as being moſt ſerviceable to mankind. The maſter of a farm ought to underſtand their nature, and what relates to their œconomics; as the uſes derived from them, their beſt vegetable food, what on the contrary is detrimental to them, and many other particulars, without the knowledge of which he might be expoſed, perhaps, to the ſudden loſs of his whole ſtock.

SECTION II.

Neat cattle are the natives of low ſituations, therefore they grow to a larger ſize, and acquire more fleſh in places liable to be flooded: there likewiſe cows produce moſt milk, as we ſee in Holland: The Cicuta* and Aconite are mortal poiſons to theſe animals; and if the plants be not carefully eradicated in their paſtures, they are frequently poiſoned.——

The

* Water hemlock.

The Herba ſanguinalis of the ancients was frequently mortal to cattle, unleſs they learned when young to avoid it.—This plant is no other than the Anemone nemoroſa*, which thoſe beaſts brought up where it abounds always leave untouched. It is not yet found in low paſture, and the cattle which are turned out of ſuch, into woodlands where it is frequent, are attacked upon eating it with a dyſentery and bloody urine, and preſently waſte away.——They ſeldom devour the Equiſetum†, except in thoſe places where it ſprings up ſo thick as to exclude all other herbs, where being compelled to feed upon it, they die with a conſumption, as the Dutch have obſerved in the neighbourhood of Utrecht. Oxen fatten very quick upon the ſea-coaſts where the Triglochin ‡, their moſt favourite food, abounds. Calves often die with famine in thoſe incloſures which abound

* Wood anemone. † Horſe-tail.
‡ Arrow grass.

abound with the Spirea ulmaria*, as they cannot eat that herb. The Oeſtra† greatly harraſs oxen; if they be ſo tied up and confined in ſummer, as not to be able to avoid their depoſiting their eggs upon them, they waſte and die: not to mention the Conops calcitrans and irritans‡, which are continually tormenting them when they have not full liberty.

SECTION III.

Grounds that are dry, open, and expoſed to the wind, are good for ſheep, who ſucced very ill confined in a fold: The Feſtuca ovina§ is their beſt fodder, and they fatten upon this ſooner than upon any other plant: this is evident in Gothland, where this Feſtuca abounds, and hence appears the reaſon why they all ruſh with ſuch avidity to places where this

* Meadow-ſweet.
† Breeze.
‡ Berk. p. 178.
§ Sheeps-feſcue.

this plant grows, though to appearance naked and almoſt barren: a particular inſtinct ſeems almoſt to guide them, and if they be deprived of it, they by no means retain ſo luxuriant an aſpect of health: We do not deny that they can ſubſiſt upon other graſſes, but they are not ſo adapted to their nouriſhment, therefore the Feſtuca is to be preferred: this makes the propoſition very clear, that many things are uſeful to man remotely and mediately, which at firſt view ſeem to have no connection with his advantages.--Thoſe neglected weeds which afford him no food, nor miniſter apparently to his neceſſities in any other manner, yet are the favourite ſuſtenance of thoſe animals whoſe fleſh we feed upon, and whoſe fur and wool is our raiment: and hence they become the means of increaſing our accommodations, and rendering them more perfect.

Sheep

Sheep are afflicted with a particular diſtemper when they drink ſtagnant water; the Faſciola hepatica* is found in their liver, which ſweeps them off by thouſands: thoſe ſhepherds, therefore, deſerve commendation, who frequently in Spring and Autumn give their ſheep ſea-ſalt, which frees them from this terrible enemy. Many marſh plants are likewiſe fatal to them, which they never touch unleſs compelled, as the Equiſetum†, Ranunculus flammula¶, Anthericum offifragum‡, and Myoſotis aquatica§; but the Kalmia anguſtifolia and latifolia‖, of North America, are the moſt fatal of all vegetables to this animal. The Oeſtrum ovinum, which is generated in the cavity of the frontal bone, likewiſe makes them ſhrink totally away: and when they are ſhut up in a cloſe pen, they are ſubject to

* Gourd-worm.
† Horſe-tail.
¶ Leſs Spearwort.
‡ Marſh aſhphodel.
§ Water mouſe-ear.
‖ Narrow and broad-leaved K.

to the mange, a diſorder very malignant and fatal, unleſs care be taken to keep them from it by the uſe of Muſk.

SECTION IV.

Goats delight in climbing the higheſt rocks, and therefore ill bear confinement; the Convallaria*, Arnica†, and Lichen‡, are their favourite foods, which abound in thoſe elevated ſituations.---They feed upon young leaves, and delight in variety of aliment; the Aconite is mortal to them, yet they browze upon the Cicuta§ with impunity: they are very troubleſome to the huſbandman by their agility in leaping over his hedges, and then deſtroying his crops: Anatomy provides us with an excellent preventative againſt this, by a ligament upon two of the tendons of their hind legs.

* Lilly of the valley.
† Arnica.
‡ Liver-wort.
§ Water hemlock.

SECTION V.

The Rhendeer of Lapland, and the Samojedes, chiefly ſubſiſt upon the Lichen rangiferinus†; they inhabit the coldeſt and bleakeſt heads of the Alps, and therefore are not ſo eaſily tamed as the Ox: if they be kept in too cloſe confinement, they are tormented with the Oeſtrum rangiferinum‡, which deſtroys them; but the Naturaliſt will be able to apply a preventative to this calamity.

SECTION VI.

Horſes which are wanted almoſt in equal numbers with oxen for the various ſervices they render to men, delight in woods and the ſhade: in dry, rocky countries, they degenerate in ſize, as the hob-

bies

† Rhendeer liverwort. ‡ Rhendeer gad-fly.

bies of Oeland. They eat Aconite, but can by no means be brought to touch the Prunus padus*, of which they deteſt the very ſmell. If they take up with their food the Curculio paraplecticus ‡, which is found under the root of the Phellandrium †, they die of the Paraplegia, a paralytic affliction of the parts under the thorax. Many alſo waſte away in ſummer with the Oeſtrum naſale ||, unleſs in the preceding Autumn their jaws have been diligently cleared the larvæ of this inſect, or they have unctious drafts given to them; oils being the common poiſon of all inſects.

SECTION VII.

He who attempts the deſtruction of any noxious animal, muſt acquaint himſelf with its nature and properties from Natural Hiſtory: Africa abounds with the Hyæna, and it would deſtroy the

* Bird cherry.
† Water hemlock.
‡ Berk. 97.
|| Grey fly.

hunter if he did not know that it ſeizes and bites every thing flung at it.——We ſhould very often not be able to eſcape the Wolf, if we were not acquainted with his circumſpective and cautious timidity in ſeizing his prey in the woods; that he is afraid of a rope dragged upon the ground; and that he never enters the gate of an incloſure, but leaps over the hedge. The Fox, taught by an inſtinct little inferior to reaſon, flees from the ſmell of gunpowder.

SECTION VIII.

The Bats, which are often extremely troubleſome, are very eaſily caught with the head of the Arctium*, coloured white, and ſuſpended in the air, which they miſtake for the Phalæna†, their proper prey; Cats, Tigers, and Lynces are eaſily enticed into a trap by the Marum, or Nepeta;

* Burdock. † Moth.

peta* ; the Sea Calf is killed by a ſlight ſtroke upon the noſe, the hare upon the neck ; the Agaric, or an egg, furniſhes a bait for the Weeſel, and for the Martin and Squirrel ; the Bear is eaſily killed in winter in his ſleeping time ; the wild Boar is deſtroyed by pepper, and Swine are kept from rooting, by cutting a tendon in the noſe ; the Mus terreſtris†, which makes ſuch havock in our barns, is effectually gotten rid of by peas, well ſteeped in an infuſion of the Veratrum‡, and laid in their holes ; the Rabbit is taken either by the ferret or the polecat ; the Hare, notwithſtanding its ſpeed, never attempts to leap over a ſtake in a hedge, but bites it. It would be too long to enter into a full diſcuſſion of the different modes by which the Mammalia are either increaſed or exterminated.

CHAP-

* Cat-mint. † Short-tailed field-moue.

‡ White hellebore.

CHAPTER II.

SECTION I.

IN like manner, birds obſerve the laws which nature has impoſed upon them, and he who expects to make profit of them muſt be acquainted with their properties. A flock of geeſe will be all killed by feeding on the Petroſelinum*, when they break into a garden; and they are kept out of a field by ſurrounding it with a horizontal cord, which they will not ſtep over: in this they reſemble the ſtag, who never leaps over a fence with ſuch a line on the top of it.

In all our accounts of China, we read what quantities of fiſh they take by means of the Pelecanus piſcator, putting a ring round his neck; if we were to train the Pele-

* Alexanders,

Pelecanus carbo*, the ſame uſe might be made of that bird, who likewiſe ſubſiſts on fiſh. Jonſton tells us of an otter in Sweden who would bring fiſh out of the ſtew-pond into the kitchen: Our poultry which are kept within in winter, are often deſtroyed by lice; the man who underſtands Natural Hiſtory will rid them of this evil, by means of pepper. It is a frequent practice to ſet the eggs of a pea-fowl under a hen, a bad practice, as the hen is unable to rear them: to preſerve them alive, the greateſt care is requiſite to keep them from feeding upon the flowers of elder, which is as mortal to them, as its berry to the hen; and it is neceſſary that the perſon who brings them up ſhould know what ſervice the nettle and onion does them. He who is acquainted with the mode of the Partridge burrowing under the ſnow, will eaſily take that bird; the Rallus crex† is taken by an inſtrument which imitates his

* Corvorant. † Land rail.

his note; and the Nightingale is caught alive by nets placed under the tree where it ſings, and fed with the eggs of piſmires, which may be procured in great abundance by digging up one of their hills on a warm, ſunny day, then holding ſome ſhade over it; the Falcon is taken in the Alps with a flying dove, while the Lanius excubitor* indicates his coming.

SECTION II.

He who has attained the knowledge of the migration of birds, and the time of their arrival, from the Kalendar of Flora, knows when he is to ſet his ſnares for thoſe Myriads of the Fringillæ† that annually arrive in Holland in the Autumn, as they are paſſing to their winter quarters in the ſouth. The Mergi‡, that cover our lakes in ſuch multitudes, are not only eaſily taken, but even fiſh, by their

* Great butcher bird. † Finches.
‡ Divers.

their means, by thoſe who know their mode of fiſhing. The multitude of obſervations which I might add here, if I were to go through all that might be ſaid upon birds, would render this branch of my ſubject too prolix.

CHAPTER III.

SECTION I.

THE Lacerta aquatica*, the worſt enemy of the fiſh-pond, is eaſily killed with ſea ſalt. Serpents are devoured by the hog and the ſtork; they are faſcinated by the Ariſtolochia anguicida† of Jacquin; the common people of my native country rub their hands with freſh Liguſticum leviſticum‡, (which is named

* Water-newt. † Mexican Ar.
‡ Lovage.

in our language Sorja, and is ſo common in Ruſſia that few gardens are found without it:) thus they handle the moſt poiſonous ſnake with impunity, and hold them in their hands motionleſs and faſcinated; and the ſame account I have likewiſe received from Siberia.

SECTION II.

He who would take the Lamprey ſhould be acquainted that they change their place only in the darkeſt night, and that they plunge to the bottom of the deepeſt pools of rivers, where they are eaſily caught by means of a hollow cone: the ſtroke of the torpedo is only to be avoided by holding the breath, the ſtrongeſt man otherwiſe cannot reſiſt it.

SECTION III.

The fiſherman will ſucceed beſt who knows the ſeaſon of the arrival of fiſh upon the ſhores from the Kalendar of Flora, and upon what bottoms they are found: thus the Bream ſeeks a graſſy ſhore, the Roach ſtony ground, Salmon white clifts by which they are inticed to chalky ſea rocks—and the Pearch loves ſtony rocks, and at different hours of the day leaves the ſhallows for the deeps.—Unleſs theſe obſervations be attended to, it will be in vain to hope to take them: when roads in winter croſs frozen lakes, the dung of the beaſts which paſs over them ſubſides to the bottom at the thaw in Spring; that part of the ſoil being enriched by it, the fiſh are aſſembled there for food; and he who knows the tract where it is paſſed, is certain of a plentiful prey.

SECTION IV.

He who would take the eel muſt be acquainted with its ways beneath the mud, their migrations in the dark, and their antipathy to white colours, and thus he will eaſily ſucceed: he who would catch the Ammodites* ſhould know that they frequent white ſands, and when they are frightened gather themſelves round in a ſpiral: to take the Cottus gobius†, we muſt underſtand how it forms its neſt and broods upon its eggs: Bellonius has told the method by which the Labri‡ are taken in Crete by the aſſiſtance of an herb, which is probably the Phaſeolus§: the Pike ſwims toward a light, and remains there as if ſtricken with admiration, and is very eaſily taken with a three-pronged ſpear; and the Carp eludes

* Sand-eel.
† Bull-head.
‡ Wraſſe.
§ Kidney-bean.

eludes our nets if the water be not puddled.

SECTION V.

He who would make a fiſh pond, ſhould know that fiſh do not thrive in ſpring water, but in ſuch as covers a bottom of good earth; he will be upon his guard againſt the pike, the water tiger, which is diſſeminated by water-fowl; ſuch a pond therefore requires to be cleared once in five years; but enough of this ſubject.

CHAPTER IV.

SECTION I.

INSECTS which are of ſuch general utility in the œconomy of nature, in particular caſes are often very deſtructive. It would exceed my ability to deſcribe any one part of their province in the animal kingdom, I ſhall therefore confine myſelf in a very narrow limit. The Blatta lucifuga are driven away by light, and killed by froſt; the Grylli domeſtici* are killed by the bark of the poplar, but freſh Daucus, mixed with flour and arſenic, is more fatal to them, for they are very fond of the ſcrapings of the Dancus; Poda aſſures us that the Blattæ will not live with theſe Grylli. The Bug, the worſt inmate to man of this claſs, is expelled

* Houſe-cricket.

pelled by a great many different means, but the beſt is the Cimicifuga fœtida*, a plant which is a native of my country. Ammannus has deſcribed it in the 76th page of his account of the plants of Ruſſia under the title of the Stinking Thalictroides, reſembling the herb Chriſtopher: and Meſſerſchmidius, in the Iſis Siberica, gives it the following character and name: Cimicifuga fœtida with the leaves of the herb Chriſtopher, bearing a thyrſus of yellow male flowers, with a red villous ſeed, the ſeed veſſel in the form of a horn. This whole plant ſo reſembles the Actæa racemoſa†, that it is difficult to diſtinguiſh them when not in flower; but in the fructification it greatly differs from it, the Cimicifuga having four piſtils, the Actæa but one. Jacquin ſays that it is a native of the Carpathian mountains; it has obtained the name of Cimicifuga, or bug-bane, both in Siberia and Tartary, from its property in

* Fetid bugbane. † Black ſnake root.

in driving away thoſe inſects; and the Botaniſts of thoſe parts of Europe which are infeſted by them, have long deſired to naturalize it in their ſeveral countries.

SECTION II.

The Coccus* is an American inſect which the Europeans purchaſe for dying at a great expence; its colour much exceeds in brilliancy the purple of the ancients. The Botaniſt knows how eaſy it would be to feed this inſect in our European gardens, taking care to protect it from all ſmoke.

SECTION III.

To make the Bees a profitable article requires an extenſive knowledge of Natural Hiſtory; to this end we muſt be acquainted

* Coccineal.

acquainted with their female government, the neutral working bee, the male drone, thoſe flowers which produce moſt wax and honey, and how we are to guard them from their enemies.

SECTION IV.

The Silk worm is a reptile which ſeems almoſt beneath contempt, but yet is moſt uſeful to man; as it not only repays largely the private cares of the cultivator, but as it confers opulence on entire kingdoms. Yet we can expect no profit from feeding the ſilk worm unleſs we underſtand its metamorphoſes, its periods of ſleeping, and the culture of the Mulberry; with the leaves of which, if the Caterpillar be not ſupplied, the hope of this rich production periſhes, the inſects continually dying with famine.

SECTION V.

The flea, a more inveterate enemy to men than women, is eaſily deſtroyed with a hare-ſkin, when we know the nature of that quadrupede.

Lice are killed by mercury, Veratrum*, Apium†, Meniſpermum‡, Ruta§, Laurus‖, Crocus¶, Penguicula**, oil, and tobacco.

SECTION VI.

The Earth worms in our gardens are extirpated by ſoot, Leeches and the Lernæa by ſea ſalt. But here we muſt conclude.

From

* White hellebore.
† Parſley.
‡ Moonſeed.
§ Rue.
‖ Laurel.
¶ Crocus.
** Butterwort.
†† Berk. 193.

From the few examples which I have brought, I think the neceſſity evident that every one who would rear and multiply for his accommodation either vegetables or animals, ought to ſtudy their properties and mode of ſubſiſtence, and thoſe laws which the great Founder of Nature has impoſed upon the inſtincts of every individual, both for its own preſervation, and that of the general order; that ſo following the guidance of nature, he may provide food, habitation, and every other requiſite for their ſubſiſtence and multiplication: but let him ſtudy Nature, her œconomy and police, not only for the purpoſes of gain, but for the pleaſure and virtue which is inſpired by the contemplation of the goodneſs of God to man.

(*A*) No true tea plant had been introduced into Europe before the year 1763; its ſeeds abound with oil, which becomes rancid, and deſtroys their vegetating power in paſſing the line.---Lagerſtrôm, counſellor of commerce in Sweden, brought two plants, ſuppoſed to be of this ſpecies, to Upſal; their fructification betrayed the fraud of the perſons they had been bought of in China, and ſhewed them to be the Camellia; the Abbè Galleau has been lately deceived by the Chineſe in the ſame manner.----The plant that generally goes under that name in Botanical gardens is the Caſſine.

Linnæus, for twenty ſucceſſive years, ſtudied to introduce this plant into Europe without ſucceſs; he ſowed the ſeeds twenty times: but, by his inſtruction, Charles Guſtavus Ekeberg, captain of a Swediſh veſſel trading to China, ſowed the freſh ſeeds in a garden-pot before he left that coaſt; the experiment ſucceeded, and theſe, which were the firſt tea plants imported into Europe, arrived ſafe October 3, 1763, and were ſent to Upſal.

There is little doubt but the tea may become a common object of cultivation in Europe: it grows ſpontaneouſly from Canton, which is under the tropic, to Pekin, in the 40th degree of North latitude: but the ſeverity of the winters on the eaſtern part of the Continent is much more than what we experience in ſimilar latitudes in Europe: by the metereological obſervations of the Miſſioners, the cold of that ſeaſon at Pekin is far more intenſe than that of Stockholm.

Am. Acad. v. 7. 239.

Mr.

Mr. Cullum has found "that it bears the open air in England without the ſlighteſt protection in the ſevereſt winter."

(B) Since the writing of this Diſſertation (1766) this conjecture has been verified. In 1768 Monſ. le Poivre, Intendant of the iſlands of Bourbon and and France, formed a plan to introduce the cultivation of this plant into the French iſlands in Africa.----The firſt expedition to the Moluccas to obtain plants and ſeeds was not attended with ſucceſs; a ſecond took place the year after, 1769; and having touched at four or five iſlands with no better fortune than before, they were ſupplied by the king of Gueby with freſh nutmegs, and the plants and ſeeds of the Clove. Coming back to the Iſle of France, they there found Monſ. Bougainville (who was on his return from his celebrated voyage round the world) with Monſ. Commerſon, whoſe zeal for the improvement of Botany had engaged him to accompany that circum-navigator, who by a certificate verified the plants and ſeeds brought back. Their exportation was immediately forbidden by ordinance: but the plants and ſeeds not ſucceeding, the Intendant fitted out two veſſels the following year for the iſland of Gueby, where they ſupplied themſelves afreſh: and Monſ. Le Poivre, before he quitted his government, had the pleaſure of having done his country the important ſervice of introducing the Nutmeg and Clove into the iſlands of France, Bourbon, and Sechelles.

This

This event turned the attention of Monſ. Maillard (who occupied a poſt of diſtinction at Cayenne, but happened to be in France when the intelligence was received) to the ſuperior probability of raiſing the ſpice plants with ſucceſs in that iſland; its climate being more ſimilar to that of the Moluccas, than thoſe occupied by the French in Africa. He communicated his ideas to the Miniſter, by whom they were approved. He was honoured with the appointment of ſucceeding Monſ. Poivre, Intendant of the Eaſtern iſlands: and having thus every facility of reducing his plan into execution, he ſent plants and ſeeds of the ſpice trees to Cayenne in 1773, and the reſult fully juſtified his views: the Cloves raiſed there, ſpecimens of which have been produced before the Academy of Sciences at Paris, ſeem to be ſomewhat ſuperior to thoſe from the iſland of Bourbon, and perfectly equal to the Clove of the Moluccas.

Extract from Mem. of the Abbè Teſſier
Journal de Rozier, vol. 14, p. 47.

DISSERTATION II.

ON THE INCREASE OF THE HABITABLE EARTH.

By *LINNÆUS.*

Amæn. Acad. v. 2. p. 409.

SUMMARY.

Introduction —— Propoſition —— Sexual pairs of animals only created——proof, from the progreſſional increaſe of mankind ——The globe originally covered by the ſea except a ſingle iſland, Paradiſe—— which muſt have contained all animals and

and plants——proof a priori, their being named by Adam——Earth could not have been filled with animals at the creation to be deſtroyed at the deluge——a poſteriori from the preſent ſtate of the earth ——from ſea ports——coaſts——water marks on inland rocks, mountains—— maſſes of ſtone apparently lodged by the ſea——Annual decrement of the ſea 4 inches 5 lines——Shells in calcarious earth not left by the Deluge——Sea becomes deeper, land broader——immenſe ſtones brought by the ſea from great diſtances——proof of the poſſibility of this ——Paradiſe an iſland under the Equator, with a high mountain in the midſt. Plants and animals of the frigid zone would live on the ſummit——temperate on the ſides. Enow vegetables would be produced to cover the face of the earth ——diſperſed by ſeeds, their number in a ſingle plant——by running roots and inflected branches——by Autumnal winds ——From the height of the trunks

of

of trees, and other circumſtances of their form——by animals——Rivers——the ſea——Rains——Creeping ſeeds——poſition of ſeed veſſels——Preſervation for many years——Concluſion.

----------Venient annis
Secula ſeris, quibus oceanus
Vincula rerum laxet, & ingens
Pateat tellus, Tiphyſq. novos
Detegat orbes; nec ſit terris
Ultima Thule. Senec. Med. 374.

The years hold on their fated way,
When ocean ſhall yield up to day
The realms that whelmed in darkneſs ſleep,
Ingulph'd beneath his ſluggiſh deep;
And ſtretching far beyond her utmoſt ſhore,
Remoteſt Thulè view new worlds unknown before.

SCRIPTURE and reaſon equally aſſures us that this aſtoniſhing machine, the Univerſe, was produced and created by an infinite Architect. For nothing is, without a cauſe; nor can man, endued

dued with reaſon, admit an infinite ſeries of ſecondary cauſes: we muſt ſtop therefore at ſome limit in this progreſſion; a primary, infinite, and abſolutely perfect cauſe.

Let us reflect upon our own natures, let us conſider animals and inſects, let us contemplate a ſingle vegetable, we every where diſcover the moſt admirable wiſdom, inimitable by any human or finite art: What genius, what art, can imitate one of thoſe fibres whoſe various and infinite complications form the human body? in its moſt minute filament we ſee the finger of God, and the ſeal of the great Artificer of Univerſal Nature. If we turn our attention to the properties of the elements, the mind is loſt in its own aſtoniſhment: If we ſurvey the ſtars removed from us by ſuch immenſe ſpaces (either by unaſſiſted ſight, or by thoſe inſtruments with which art has improved it) conſider their laws, their magnitudes, their

their courſes in the depths of an infinite ſpace; preſcribed to hours, minutes, moments, our mind muſt be filled with the idea of an infinite power and wiſdom, and their infinite Architect. The life of man would be inſufficient to recapitulate in the briefeſt manner all the ſeparate wonders of his production, much more thoroughly and fully to conſider them.

Under the protection of this gracious being, I have determined on this occaſion to enter into the reaſons which have induced me to believe,

That at the beginning to the world, there was created only one ſingle ſexual pair of every ſpecies of living things.

To the proofs of this propoſition, I requeſt thoſe who are my auditors to lend a favourable ear and willing attention.

Our holy Faith inſtructs us to believe that the Divinity created a ſingle pair of the human kind, one individual Male, the other Female: The ſacred writings of Moſes acquaint us that they were placed in the Garden of Eden, and that Adam there gave names to every ſpecies of animal, God cauſing them to appear before him.

By a ſexual pair I mean one male, and one female in every ſpecies where the individuals differ in ſex: but there are certain claſſes of animals natural Hermaphrodites, and of theſe only a ſingle individual was originally formed in each kind.

Experience teaches that in ſingle and excluſive marriages both in men and animals, the offspring produced exceeds the number of the parents.---Theſe as they grow up become further multiplied; thus in the deſcending line, in every ſtep which we

we ſtop to conſider, we find the numbers always greater than in the next above which immediately precedes it; and the numbers of every ſpecies now exceed what they formerly were. If we trace this train back in the oppoſite order, and conſider the aſcending ſeries, we ſhall find the number of individuals leſs and leſs at every ſtep *; ſo that many owe their origin to few, theſe to ſtill fewer, and ſo on till the decreaſing progreſſion terminates in an individual pair; and the firſt link in this chain of ſecondary cauſes muſt be referred to an act of creation in the Deity.

To enter into the remainer of this ſubject with as much brevity as poſſible, I think myſelf not greatly in danger of error in laying down the following propoſition: "*That the Continent in the firſt ages of the world lay immerſed under the ſea, except a ſingle iſland in the midſt of this immenſe ocean; where all animals lived com-*

* See Note (*A*) at the end of this Eſſay.

commodiouſly, and all vegetables were produced the greateſt luxuriance.

Nos manet oceanus circumvagus: arva beata
Petamus arva, divites et inſulas.

Unbounded ocean opens to our courſe
Thoſe golden iſles the fields, the happy vales,
Invite our bark, and call our ſwelling ſails.

We had before learned from the declarations of revelation, and the teſtimony of reaſon, that of mankind a ſingle individual only of each ſex was created. By the Moſaic Hiſtory we are informed that Paradiſe was given to Adam for an habitation, and that the various ſpecies of animals contributed there to his pleaſure and conveniency.

Now if all the animals were in Paradiſe, which appears from Adam's giving them

them names, all the inſects muſt have been inhabitants of Paradiſe; and therefore all the ſpecies of vegetables muſt have had their ſtations aſſigned them in this delightful garden. For every vegetable nouriſhes its peculiar inſect, and moſt inſects are confined for their food to particular vegetables.

An infinite number of examples may be brought in proof of this.

The Silk worm cannot live or be propagated but where mulberry-tree is plentiful.

The Coccionella lives upon the Indian fig only.

Some ſpeeies of fiſh ſubſiſt only upon particular worms, as the Greenland whale upon the Meduſa*. Some live only upon herbs, as the Cretan Scarus, or Char.

There

* Sea nettle.

There are birds who feed only upon certain berries, as the Ficedula*, upon figs and grapes. Others who eat nothing but particular kinds of inſects allotted to them, as the Pici†: thus flies are the food of the Muſcicapa‡,---Shell fiſh to the Hæmatopos§, Ants to the Myrmecophaga, Earth worms to the mole, the nocturnal Phalænæ to the Bat‖.

Fiſh and birds of prey live upon other ſpecies of their own tribe, they are the Hunters of their reſpective elements.

Thus one animal by the death of another ſupports its life, which it cannot prolong unleſs it finds a table ſpread, ſuited to its natural appetite.

Beſide if that part of the globe occupied by land and the continent had been originally

* Fig-pecker. ‡ Fly-catcher.
† Wood-pecker. § Sea pie.
‖ See Note (*B*) at the end of this Eſſay.

originally of the ſame extent which it is this day, it would have been difficult and almoſt impoſſible for Adam to have found every animal; their natural wildneſs would preſently have diſperſed them over the whole earth: to think the land was originally created of the ſame ſize that it is at preſent, equally full of herbs and trees, equally inhabited by animals, and only two of the human ſpecies placed in a ſingle corner of it, is as abſurd as to ſuppoſe the planet Jupiter ſimilar in all reſpects to our globe, and abounding in plants and animals, but not to be inhabited by man or any other rational being, to conſider this ſcene of beauty, and repay the debt of glory to his Creator.

Is it credible that the Deity ſhould have repleniſhed the whole earth with animals to deſtroy them all in a little time by a flood, except a pair of each ſpecies preſerved in the ark?

He who has ordered all things with the moſt ſingular wiſdom, and has regulated the number of the offspring of every kind of animal with a proportion ſo exact, employed certainly as accurate a calculation in creating them. He has done nothing in vain, nothing inconſiſtent with the laws he has once laid down; if we ſhould admit that many individuals of any ſpecies of living thing were created and diſperſed over all the world, we at once aſſign limits to creation beyond which it could not extend: and what reaſon can plead for multiplying creations in one ſpecies, when by that of a few, a ſingle pair, a ſingle individual the ſame might be obtained.

Let us now proceed to the conſideration of the earth itſelf, and we hope the truth of this propoſition will clearly appear a poſteriori.

It is evident from ocular inſpection that the lands increaſes from year to year, and that

that the bounds of our continent are extended.

We ſee the ſea ports of Eaſt and Weſt Bothnia every year decreaſing, and becoming incapable of admitting veſſels, by the ſand and ſoil thrown up, which are always adding new increments to the ſhore: the inhabitants of the ports are obliged to change their ſeats, and ſometimes remove a quarter of a mile nearer the ſea; of this we have ſeen examples at Pithoa, Luloa and Hudwickval.——On the Eaſtern ſide of Gothland near Hoburg, the increaſe of the continent for the laſt 90 years is diſtinctly viſible, being about 2 or 3 toiſes annually.——Near Slite and Kylle, in the ſame country, are enormous ſtones which rudely repreſent large temples, giants, and Coloſſal ſtatues in their magnitude, yet worked out of the moſt ſolid rock by the force of the water.

The two very tall mountains of Torſburg and Hoburg, in Gothland, are formed of calcarious rock, and were marked and hollowed out by the force of the water at the ſame time that all Gothland lay immerſed in the ſea, except theſe two mountains, which raiſed their heads out of the deep in the ſame manner, and with a ſimilar appearance to the Carolinian iſlands in their preſent ſtate.

It is impoſſible to ſee without admiration the immenſe maſſes of ſtone and rock which every where lie ſcattered without order upon the face of the earth; when broken they are found to conſiſt of mica, quartz, and ſpat; an evident indication that they (as well as all other ſtones) were formed of earth, and produced in ſubterraneous places; but by the force of the waves they were freed from the ſuperincumbent earth, and caſt upon the ſhore; as we frequently ſee ſimilar maſſes upon the coaſts.

The

The inhabitants of Weſt Bothnia have obſerved by marks upon *ſtones* (rocks?) that the ſea decreaſes every ten years four inches five lines perpendicularly; which amounts in an age to four feet five inches. According to which calculation 6000 years ago the ſea was 240 feet deeper than it is at this preſent*.

To theſe proofs we may add the infinite number of ſhells of ſea fiſh found in calcarious mountains. —— The calcarious Mountains at Rætvic and Dalicum are full of petrified Conchs and Orthocerotes. ——That Conchaceous earth ſo frequent in Helſingia is all compoſed of fragments of Mytuli†, or conchs, of a dirty yellow colour: no man can be ignorant that the ſea, not the dry land, was the place of their production; that theſe Conchs and bivalves are found at a certain diſtance from

* A. Celſii Obſ. in Act. Acad. &c. Sueciæ 1749, p. 33. See alſo Note *(C)* at the end of this Eſſay.

† Muſcles.

from land, and not in the deeps; who does not ſee the ſea caſt forth upon the ſhore the teſtaceous coverings of its dead ſhell fiſh?—Hence we infer that the ſea once penetrated 20 miles up into Dalekarlia, or further, wherever any veſtiges of ſhells are to be diſcovered.

Vidi factas ex æquore terras,
Et procul a pelago conchæ jacuere marinæ,
Et vetus inventa eſt in montibus anchora ſummis.

Theſe eyes have ſeen
New plains extend where ocean rolled before,
The Conch far diſtant from his ſea-beat ſhore;
And on the Pine-robed Alps cloud-cinctured head
The mouldering anchor for long ages laid.

Whoever aſcribes theſe circumſtances to the Deluge, which came ſuddenly and was as ſuddenly paſt, muſt be totally ignorant in Natural Philoſophy; and if he ſees any thing, ſees with the eyes of others.

The ſea every year becomes deeper by caſting up earth, ſand, and ſtones upon the ſhores, hence the earth increaſes in breadth, the ſea in depth, and occupies the void ſpace made by the earthy matter it caſts up, while it is ſtreightned on every ſide in narrower limits.

About Hoburg in Gothland I have ſeen immenſe ſtones, moveable by no animals or human art, yet caſt up by the ſea upon the ſhore: they conſiſted of pure marble, of white and red particles; a ſpecies of ſtone not produced in this country but in the Carolinian iſlands, from whence without doubt they were transferred hither by the force of the waves, eſpecially as they were upon the eaſtern ſhore. One ſtone of a particular ſize, of that kind called micaceous, lies at the diſtance of a quarter of a mile from Hoburg; it is too large for any application of human force to have moved, yet it does not lie in the place where it is generated; for the neigh-

neighbouring matter is not proper for that purpoſe: from hence we may infer that it was brought hither by ſome violent commotion of the ſea from Sweden or Muſcovy, while Gothland was yet immerſed under it.

Three years ago being at Fulleron, an eſtate of the ſenator Cronſtedt, I ſaw a fragment of rock left by the water upon the ſhore where the inhabitants imbark: —Every body can give evidence to this fact, and that ſuch a ſtone had never been ſeen in that place before. If the Lake Melerus have force enough to move ſtones of a weight that many yokes of oxen are unable to draw, what muſt we expect from the ocean?——In the Dalic rocks, where Palmfjdllet borders upon the Lake Gruſvelsjon, the eaſtern ſide of the mountain Wolen is annulated and worn away; a manifeſt indication of the effect of the waves once waſhing againſt it.

The ſections of all rivers are wide at the ſurface, narrower at the bottom, and they every year excavate their beds deeper: the Simois and Xanthus which watered the meadows of Troy, ſo celebrated by the poets, are ſaid by Bellonius now to be ſo diminiſhed as not to be able to nouriſh the ſmalleſt fiſhes; they are quite dry in ſummer, and in winter "have ſcarce water enough to ſwim a gooſe."—At the Salmon leap at Luloa, in Lapmark, the height of the river has been every year conſtantly marked, and it appears annually decreaſing.

From all theſe arguments I think we ſhall be juſtified in drawing the following concluſion, that the dry land is in a ſtate of augmentation; that formerly it was much leſs than it now is, and at firſt a ſingle, ſmall iſland*, in which, as in a compendium, all things were collected together which our gracious Creator had deſtined to the uſe of man.

* See Note (*D*) at the end of this Eſſay.

We muſt now point out how it might have been effected, " *that all vegetables in a ſmall tract of land might find their proper ſoil, and every animal its proper climate.*

Firſt let us conceive Paradiſe ſituated under the Equator; and nothing further is requiſite to demonſtrate the poſſibility of theſe two indiſpenſible conditions, than ſuppoſing a very lofty mountain to have adorned its beautiful plains.

The higher a mountain riſes into the middle regions of the air ſo much the more intenſe is the cold it is expoſed to. The mountain of Ararat in Armenia preſerves an eternal ſnow upon its ſummit, as well as the rocks of Lapland in the Arctic circle: the ſame cold reigns on both; and on the tops and ſides of ſuch a mountain the ſame vegetables might grow, the ſame animals live, as in Lapland and the frgid zone: and in effect we find in the Pyrenean,

Pyrenean, Swiſs, and Scotch mountains, upon Olympus, Lebanon, and Ida, the ſame plants which cover the Alps of Greenland and Lapland.

Tournefort, in his Journey to the Eaſt, makes one obſervation which deſerves to be remembered on the preſent occaſion: "I found, ſays he, at the foot of Mount Ararat thoſe plants which were common in Armenia,—a little further thoſe which I had before ſeen in Italy; when I had aſcended ſomewhat higher ſuch vegetables as were common about Paris; the plants of Sweden poſſeſſed a more elevated region; but the higheſt tracts of the mountain, next the very ſummit, was occupied by the natives of the Swiſs and Lapland Alps."——By the plants growing upon the Alps of Dalecarlia, I was able to calculate how much lower theſe were than thoſe of Lapland; for in Lapland I had accurately obſerved the heights at which I found every vegetable.

From the works of Cæſalpinus it is evident, that he reckoned all thoſe plants that are common in the fields of Sweden under the title of Alpine plants, as he had found them growing in the mountains of Tuſcany, which, however, are not Alps.

Hence we are authorized to conclude, that the height and elevation of land expoſes it to cold; and that the coldeſt winter, and perpetual ſnow might be found under the line, upon a mountain of ſuch a height that its top aſcended above the region of the clouds.

Here we foreſee a difficulty will be ſtarted by ſome, how ſuch a number of vegetables, ſuch immenſe woods and thickets, thoſe multitudes of flowers that cover every field and meadow, can have been diſſeminated over the world by ſingle plants.

Laurembergius numbers 3000 ſeeds from a ſingle root of the Helenium*, 2000 in a ſingle plant of the Zea, which number in Virginia muſt be doubled, becauſe it is there ſown and reaped twice a year. In the Helianthus†, Camerarius obſerved 4000 ſeeds; in a poppy, bearing four ſeed veſſels, in every veſſel Trevius numbered 10 receptacles, and in each of theſe, 80 ſeeds, making in the whole plant 3200: The tobacco, in a rich ſoil, produced 40320, every plant yielding from 6 to 7 drams, every one of which contained 60 grains Apothecary's weight, and every grain 120 ſeeds.

Hitherto we have eſtimated the multiplication of a ſingle plant by ſeed for one year: but the greater number of plants have perennial roots, ſome of which laſt for a century, others three centuries and a half, as the oak:—Some plants are propagated

* Baſtard ſun-flower. † Sun-flower.

pagated by branches and ſuckers, as the Rhizophora, and the Arbor de Rais, whoſe branches bending down toward the earth, ſtrike freſh roots; the curved part produces new branches, which with their growth becomes again inflected; and if we may believe tradition, Artaxerxes, with his whole army, paſſed a night under the branches of one of theſe trees: beſide the roots of ſome vegetables creep horizontally under the earth; thus plants are renewed, multiplied, and produce new ſuckers*.

It appears from this view of the ſubject, that even a ſingle plant, if it were preſerved from animals and every other accident, might have cloathed and covered the ſurface of the globe.----Let us ſuppoſe that plant to have been a ſingle annual, with one flower, and two ſeeds only;

* There are 48 genera enumerated by Linnæus, whoſe multiplication is thus increaſed.

only; in the firſt year it would produce two, the ſecond four, the third eight, and on the twentieth year there would be 1,048,600 individuals of that ſpecies.--- What myriads would 6000 years have produced? but a plant whoſe increaſe is ſo ſlow is not to be found in nature, for as we have obſerved above they all produce ſeeds in great numbers.

I now muſt intreat your attention to another neceſſary part of my ſubject, which is to prove how, *from a ſingle central ſpot, a plant of a given ſpecies may be ſo diſſeminated as to be found in all parts of the world.*

The efficacy and force of the air is the firſt thing which preſents itſelf to our conſideration; which by the admirable inſtitutions of Providence, in Autumn in particular, even rocks our ſolideſt buildings, and ſhakes the trees ſo that their leaves fly in the air like flakes of ſnow: but

but as it bruſhes over the face of the earth, it raiſes thoſe ſeeds which were dropped, and carries them along to diſtant regions, where they are left to germinate; ſcarcely an age is paſt ſince the Canadian Erigiron* was brought from America to the phyſic gardens at Paris; the ſeeds being carried by the winds, the plant is already diffuſed over France, the Britiſh Iſlands, Italy, Sicily, Holland, and Germany. The Antirrhinum minus† of Bauhin is now a common plant about Upſal, though it undoubtedly was diſſeminated from the Academical Gardens: the Datura‡, Cotula§, Berberis, and the American Gnaphalium‖, might be brought as further confirmations of this point, if the ſhortneſs of time would permit it. Nature has elevated the ſeed veſſels of plants upon trunks or high ſtems, that their

* Flea-bane
† Leſs toad-flax.
‡ Thorn-apple.
§ May-weed.
‖ Am. Cud-weed.

their ripe ſeeds may be carried a great way by the wind*.

If we regard the figure of the capſules of vegetables, we ſhall find them opening at the apex; leſt the ſeeds ſhould drop out even when ripe, without being widely diſperſed by the wind: the Hyoſcyamus† has a cover on the top of the ſeed veſſel, which opens horizontally when they arrive at maturity, but they do not fall out unleſs the plant be ſtrongly ſhaken, that the ſeeds may be very widely ſcattered: without this cover of the capſule they would be in danger of periſhing by drought, or germinating by moiſture there. That ſome ſeeds may be diſperſed at a great diſtance from the parent plant, nature has furniſhed them with ſomething like wings, and a pappous down, by which, after they come to maturity, they

 are

* Linnæus gives liſts of 365 genera whoſe ſeeds are further diſperſed by this means.

† Hen-bane.

are carried up in the air, and have been known to fly to the diſtance of 50 miles*. The divine wiſdom has ordered in others, that their containing veſſels ſhould expell them as ſoon as they are ripe, and often dart them to a great diſtance†: the Ruellia only darts out its ſeed under a wet dropping atmoſphere, ſuch weather is neceſſary for them, leſt they ſhould periſh at firſt by drought. Others are furniſhed with hooks, by which, when ripe, they adhere to the coats of animals, and are carried by them to their lodging places; moſt of theſe vegetables require a ſoil enriched with dung‡.

Other plants produce a berry, or have their ſeeds ſurrounded by a nutritious juice: they are picked up by birds and other

* One hundred and thirty-eight genera have wingded, or pappous ſeeds, or inflated ſeed veſſels.

† We have a liſt of 29 genera with elaſtic ſeed veſſels.

‡ Linnæus names 50 genera thus armed.

other animals, who pay for the nouriſhment they receive by recommitting the ſeed fertilized to the earth: if they be ſwallowed whole, they are ejected uninjured, except from the Gallinaceous order of fowls who have gizzards. It is thus the fox diſſeminates the privet, man, many ſpecies of fruit: all the Sorbs found growing upon walls and houſes, are derived from birds muting there: with ſuch care has nature provided for the ſeeds of theſe plants, at once fertilizing and diſperſing them every where. It is the ſame caſe with many other ſpecies, as the Epidendron, the Juniper, the Viſcum †; if their ſeeds be received unhurt, they paſs through the bowels of birds and animals uncorrupted.

It ſeems extraordinary to many, and ſomething of a prodigy, that when a field

* Of theſe plants included in an eſculent ſubſtance he reckons up 193 genera.

† Miſsletoe.

is well tilled and ſown with the beſt wheat, it frequently produces darnel, or the wild oat, eſpecially if it be manured with new dung: they do not conſider that the fertility of the ſmaller ſeeds is not deſtroyed in the ventricle of an animal, and that a great part of the oats eaten by a horſe do not loſe their faculty of germinating in his ſtomach.

The growth of other ſeeds is promoted by birds and animals in a different way: while ſome are eaten, others are ſcattered and trodden into the ground by them:— the Squirrel gnaws the cones of the pine, many of the ſeed fall out: when the Loxica eats off their bark, almoſt his only food, many of their ſeeds are committed to the earth, or mixed in the moraſs with moſs, where he had retired to make his meal. The Glandularia, when ſhe hides up her nuts, often forgets them, and they ſtrike root. The ſame is obſervable of the Walnut; mice collect

and

and bury great quantities of them, and being killed by cats, weazles, or owls, they afterwards germinate.

But there are many other ways in which animals contribute to the diſperſion of ſeeds.

The Earth worm piles up ſeeds in little heaps, which there ſpring: the mole, when he digs under the earth to catch the earth worm, flings up little hills proper for vegetation: the ſwine, in their ſearch after roots, breaks the ground as much as if it were plowed, covers the ſcattered ſeeds with earth, and while they fatten upon acorns, plant oaks. The hedge-hog is thus employed during his whole life.

We are aſtoniſhed to find Moſſes, Fungi, Byſſus, and Mucor growing every where; but it is for want of reflecting that their ſeeds are ſo minute as almoſt to eſcape the

the naked eye*; they float in the air like atoms, and are dropped every where, but grow only in thoſe places where there was no vegetation before: for this reaſon we find the ſame Moſſes in North America and Europe.

In Lapland we ſee the moſt evident proofs how far rivers contribute to depoſiting the ſeeds of plants: I have ſeen Alpine plants growing upon their ſhores frequently 36 miles diſtant from the Alps; for their ſeeds falling into the rivers, and being carried along and left aſhore by the ſtream, take root there.

We may gather likewiſe from many circumſtances how much the ſea furthers this buſineſs.

In Roſlagia, the iſland of Græſoea, Oeland, Gothland, and the ſhores of Scania, there are many foreign and German plants

* The number of genera amounts to 14.

plants not yet naturalized in Sweden. The Centaury is a German plant, whoſe ſeeds being carried by the winds into the ſea, the waves landed this foreigner upon the coaſts of Sweden: I was aſtoniſhed to ſee the Veronica maritima, a German plant, growing at Tornoa, which hitherto had been found only in Græſoea; the ſea was the vehicle which tranſported this plant from Germany thither, or poſſibly they were brought from Germany to Græſoea, and from thence to Tornoa.

Many have imagined, but erroneouſly, that ſeed corrupts in water, and looſes its principle of vegetation: Water at the bottom of the ſea is ſeldom warm enough to deſtroy ſeeds; we have ſeen water cover the ſurface of a field a whole winter, while the ſeed with which it had been ſown continued unhurt, unleſs at the beginning of Spring the water were let down ſo low by drains, that the warmth of the ſun beams reached to the bottom;

bottom; then the ſeeds germinate, but preſently become putreſcent; ſo that for the reſt of the year the earth remains naked and barren. Rain and ſhowers carry ſeeds into the cracks of the earth, ſtreams, and rivers, which laſt conveying them to a diſtance from their native places, plant them in a foreign ſoil.

A rainy diſpoſition of the air inclines plants to cloſe their ſeed veſſels, leſt any moiſture mixing with the ſeeds, ſhould glue them together, or make them germinate. The Anaſtatica is a plant very ſingular in its nature, the branches on every ſide are contracted round the pericarpium (like the hand ſtrongly graſping any thing within it) leſt the ſeeds ſhould fall out and be picked up by the birds; this plant grows on the ſandy ſhores of the red ſea, and is ſwept away whole by the autumnal tides; but when in the following ſpring it flings up its wreck upon the ſhore, and this plant is caſt up with

it

it, it is not at all affected with the cold of the ſea water, but in that which is warmed it expands its branches and lets fall its ſeeds, which when the water runs off take root.——The ſtructure of ſome plants likewiſe favours their propagation; the Medicago* has its ſeed veſſels formed like a cockle, as are the ſeeds of the Salicornia‡, and Salſola§, which grow no where but upon the ſea ſhores, which are covered with thoſe ſhells; and without doubt the birds and fiſhes which derive their foods from ſeeds and leaves they find in the ſea, frequently paſs them over, thinking them to be real cockles.

It is curious to obſerve with how much care nature has guarded certain plants, leſt their flowers and fruits ſhould ſuffer by birds and animals, fortifying them on every ſide with thorns and ſpines†: theſe plants grow very copiouſly in deſert places

* Medick. ‡ Marſh ſampire. § Glaſswort.
† Linnæus inſtances 86 genera thus protected.

free from the injuries of animals, and hence the earth is ſo fertile in thorns and thiſtles.

Seeds themſelves ſometimes endeavour to aſſiſt their projection to a diſtance: The Crupina is a ſpecies of Centaury, its ſeeds are covered over with erect briſtles, by whoſe aſſiſtance it creeps and moves about in ſuch a manner, as it is by no art to be kept in the hand: if you confine one of them between the ſtocking and the foot, it creeps out either at the ſleeve or neck-band, travelling over the whole body. If the bearded oat, after harveſt, be left with other grain in the barn, it extricates itſelf from the glume, nor does it ſtop in its progreſs till it gets to the walls of the building.—Hence the Dalecarlian, after he has cut and carried it into his barn, in a few days finds all the glumes empty, and the oats ſeparate from them: for every oat has a ſpiral ariſta, or beard, annexed to it, which is con-

contracted in wet, extended in dry weather; when the ſpiral is contracted, it drags the oat along with it, the ariſta being bearded with minute hairs pointing downward, the grain neceſſarily follows it; but when it expands again, the oat does not go back to its former place, the roughneſs of the beard the contrary way preventing its return: If you take the ſeeds of Equiſetum, or fern, theſe being laid upon paper, and viewed in a microſcope, will be ſeen to leap over any minute obſtacle as if they had feet; by which they are ſeparated and diſperſed one from another; ſo that a perſon ignorant of this property, would pronounce theſe ſeeds to be ſo many mites, or ſmall inſects.

Other wonderful modes of propagation are diſcoverable in other plants, as in the Arachis*, the Lathyrus†, the Trefoil, and the Valantia‡.

* Ground-nut. † Chickling-vetch.
‡ Croſs-wort.

The Valantia cruciata‡ has its flowers upon ſmall peduncles ſcattered over the whole plant; the few ovaria it bears, by a wonderful contrivance, are hidden underneath the leaves, which bend down and conceal theſe ſeed veſſels, ſo that not one in the whole plant lays open to the birds:—The globous Trefoil, with globular hairy heads, the upper calyces deſtitute of flowers, has in every one of its heads a few flowers covered with briſtles and hairs; after the flower is off, this hairy ſubſtance continues compreſſing and totally covering the ſides of the head, ſo that the birds who come to it in queſt of food return diſappointed; the ſeed having thus eſcaped them, is afterwards depoſited in the earth, when the deciduous capitulum has been broken off from the ſtalk, and agitated by the winds. When the flowering time of the Subterraneous trefoil arrives, it puts forth a peduncle with

‡ Croſs-wort.

with five buds, which bends down toward the earth, and even buries itſelf half its length in the ground; the flowers, and their bracteæ, which reſemble roots, are recurved; and the ſeeds are ſo cloſely confined in them, that they have the appearance of peas fixed in the earth. —The Subterraneous lathyrus bears upon upon its ſtalk a few flowers, fewer ſeeds; —under ground there ſpring ſome white flowers, not variegated like thoſe which grow upon the ſtalk above ground, but bearing ſeed, which at firſt is thus committed to the earth, leſt it ſhould be expoſed to danger from birds and animals.

The Arachis* is a plant ſomething reſembling the bean: it ſhoots out of its ſtalk peduncles loaded with flowers; but the time of flowering being paſt, theſe peduncles are incurved toward the earth, enter it, and lodge their leguminous ſeed veſſels in its boſom, filled with ſeeds that yield

* Ground-nut.

yield an oil as ſweet as the oil of almonds: if nature had not thus provided for them, but left them to ripen above ground, they would have ſoon become rancid and uſeleſs; and never could have been ſown with any hope of growing. ——The Fir and Pine are provided for almoſt in the ſame manner; their oily ſeeds become rancid and barren with the leaſt continued heat: while the fir remains in flower its cones are erect and ſpreading; but when the time of flowering is over, they drop their points downward, and their imbricated texture becomes ſhut cloſe by degrees, as the winter colds come on, that the water may run off them with the ſame facility as it does from tiled roofs: in the beginning of April, when they are warmed by the return of the ſun, the cones open, and ſhed their ſeeds; which received in the boſom of a warmer earth, and moiſtened by the ſhowers of ſpring, eaſily ſtrike root; yet they would have almoſt all periſhed

riſhed if the cone had been expoſed to the heat of ſummer.

The ſeeds of ſeveral plants differ in the time they lay in the ground: even ſome ſpecies lay a ſhorter or a longer time, one year, or two, before they ſpring up.---- Such are the Roſe, the Meſpilus*, and the Juniper.——In a very early period of my youth I made a ſmall garden, in which I ſowed all the plants I could procure; and among others a ſpecies of the Carduus, which was every year drawn up by my father before it went into flower, for fear of its ſeed diſperſing over the reſt of the garden; nevertheleſs every year new plants of this ſpecies ſprung up, nor have I any doubt but that ſome of the ſeeds have all this time lurked in the earth, and annually make their appearance:—Hence we may gather the cauſe why grounds over-run with thiſtles are with ſo much difficulty cleared, though they

* Medlar.

they be plowed up, harrowed, and their roots drawn, yet the ſeeds being once ſcattered, new thiſtles will ſpring the next, the following, the third, or even the tenth or twentieth year:----The Hypecoon procumbens* had been loſt out out of the Garden of Upſal ſince the time of Rudbeck the father; but it came up again the twentieth year of the preſent century, as they were breaking up the earth in a particular part; the ſeed had laid dormant there above 40 years.—— The Lobelia† ſix years ago ſuddenly reappeared in the Phyſical Gardens at Amſterdam, which had been loſt there above twenty years,

The ſeeds of Caſſia, the ſenſitive plant, and the Melon retain their vegetative faculty forty or fifty years, if you give them abundance of water.——Thus the all wiſe Creator has provided, that if ſeeds be depoſited in a place which is too dry

* Trailing Hyp. † Cardinal-flower.

dry, or in an improper ſoil, that time ſhall not deſtroy them, but that they may expect to be transferred to a ſpot better adapted to them: others ſpring up in different years, that if their uſual time of year be unfavourable to them, at the next return of the ſeaſon they may meet better fortune.

Thus you have heard with how exquiquiſitely wiſe and attentive a care the great Artificer of Nature has provided that every ſeed ſhall find its proper ſoil, and be equally diſperſed over the ſurface of the globe.

We have ſeen the Winds, the Rains, the Rivers, the Sea, Heat, Animals, Birds, the Structure of Seeds, and Seed Veſſels, the peculiar Natures of Plants, and even Ourſelves, contribute to this great work. ——I have ſhewn, that any one ſingle plant alone would have been able to have covered the face of the globe:——I have

demonſtrated that the dry land has always been increaſing, and dilating itſelf; and therefore once was infinitely leſs than it is at this preſent: —— I have traced back the orders of animals and vegetables, and found them terminate in individuals created by the hand of God.

If we add to this the proportion which ſubſiſts between carnivorous animals, and thoſe ſubſiſting upon vegetables, among birds, fiſhes, and inſects, and between the Animal and Vegetable Kingdom; if beſides we ſtrengthen theſe inductions by the analogy of our Concluſion with the hiſtory of the Deluge, no one I believe will be able to ſay, that I have aſſerted without foundation, that one individual of every ſpecies of plant, and one ſexual pair of every ſpecies of animals, was created at the beginning: ——Thus the Garden of Paradiſe is rendered the moſt beautiful imagination can conceive, and the infinite glory of the Creator exalted, not

de-

depreſſed. Let thoſe of this Aſſembly to whom the Parent of Nature has given a more happy genius, who poſſeſs an erudition more cultivated, and are more acute in the diſcovery of whatever the rules of genuine demonſtration lead us to, let thoſe with ſuperior accuracy carry theſe enquiries to their ultimate end.—— *Dixi.*

(A) This reaſoning may be confirmed by an obſervation on the natural hiſtory of civil ſociety, firſt I believe laid down by Monteſquieu; that of its three ſucceſſive ſtates of Hunting, Paſturage, and Agriculture. ----Savages, for their hunting grounds, require vaſt tracts of land in proportion to their numbers, and a given diſtrict maintains very few inhabitants: more animal food is procured by paſturage from the ſame territory, and their numbers will be encreaſed in the ſame proportion: agriculture furniſhes ſtill more of the neceſſaries of life, and carries the population to its higheſt degree. * It has been calculated that half an acre of arable land produces as much food as 800 acres of hunting grounds. If we trace this progreſs backward, we

* Pau Recherches ſur les Americaias, v. 3. p. 123.

ſhall find the numbers of mankind ſucceſſively diminiſh agreeable to the reaſonings uſed by Linnæus.

As this is a ſubject of ſome curioſity at leaſt, I ſhall beg leave to hazard a conjecture upon the fixed order in which theſe ſtates always ſucceed each other, but with that reſerve with which opinions ought at firſt to be laid down; *that by this eſtabliſhed order of the ſtages of ſociety, a country becomes peopled with the greateſt rapidity poſſible.*

In tracts of land almoſt fully inhabited, the increaſe of population is but ſlow----Suppoſe a ſmall tribe ſituated in the central ſpot of an uninhabited tract, and as they multiplied, their habitations to be as contiguous as thoſe of well peopled countries in Europe, the rapidity of their increaſe would ſoon be checked in the internal parts of the ſettlement; and the exterior bounds alone would keep up the original celerity of population: but it is capable of demonſtration that this celerity would decreaſe upon the whole as the number of people in the whole ſociety increaſed. This we ſee in the oldeſt American colonies, where on the ſea coaſt the increaſe of population does not much exceed that of Europe, while the multiplication in the back ſettlements is immenſe. But if we were to ſuppoſe that as faſt as this ſmall central tribe increaſed, the added numbers were detached to diſtant ſtations, this celerity of increaſe would continue at its original rate untill the whole country was covered with theſe ſcattered ſettlements; and the people being thus equally diſſeminated,

every

every little ſociety would multiply with the greateſt poſſible rapidity, till the country was covered fully and equally with inhabitants; every new detachment forming a new punctum vitæ of population.

The paſſion or neceſſity of ſavages for hunting is a moral principle of repulſion, which makes them ſcatter themſelves in a manner ſimilar to that above deſcribed: when the hunters are ſpread over the whole face of country, and become full as numerous as their lands will ſupport, the ſtate of paſturage muſt take place, and they are enabled by their former diſperſion to multiply into the greateſt number that ſtate is capable of ſuſtaining, in the ſhorteſt time. At length agriculture ſucceeds to paſturage by the ſame neceſſity with which paſturage ſucceeded to hunting, and finds the tribes of ſhepherds diſperſed equally over the face of the country at as great a diſtance as this increaſe of population will admit, in ſuch a manner, that the country becomes fully peopled with the greateſt rapidity. In the neceſſity of diſperſion impoſed upon the two ſavage ſtates, we diſcover the reaſon why even the worſt parts of the earth are not found uninhabited.

The hunters who inhabited the fineſt tracts of country muſt have found themſelves burthened by an increaſing population, and ſuffered ſeverely by frequent famines, before they learned to keep herds of tame cattle. The game of the better regions being exhauſted, part of the inhabitants were forced to migrate to thoſe which were worſe: and the ſame neceſſity took place

again

again toward the concluſion of the ſtate of paſturage. Thus they were obliged to deſert the beautiful climates of the ſouth, and ſpread themſelves over the dreary wilderneſſes of the north.

' But the hunter-ſtate which Monteſquieu has placed firſt, is probably only the ſecond ſtage to which mankind arrived: ſo many arts muſt be invented to catch a ſalmon or a deer, that ſociety could no longer be in its infancy when they came into uſe. The diſtance ſeems as great from the uſe of a ſtone to that of a bow and arrow, as from the latter to the diſcovery of fire arms; and the race of man muſt have periſhed many times over before they could take fiſh, or eat veniſon.---I therefore incline to adopt the Hypotheſis laid down in the firſt Diſſertation by Aphonin, a Ruſſian Nobleman, that mankind originally ſubſiſted upon the ſpontaneous fruits of the earth, and that their original ſeat was between the tropics, as man is born without any covering, and the ſpontaneous fruits of the earth are only to be found in ſufficient plenty there; but that thoſe regions becoming over peopled, they diffuſed themſelves into the neighbouring parts of the temperate zone. It muſt have been a conſiderable time before this event took place: and it is poſſible, that in the interval while from the multiplication of their numbers the neceſſity of migration was increaſing upon them, and the period in which it became abſolutely neceſſary, ſome arts to take animals might be invented, but far inferior to what we ſee practiſed at this day among ſavages.---

Or

Or as their habitations were gradually advancing into the temperate zone, the new difficulties they had to encounter increaſing upon them gradually muſt have been enough to call forth all the ſpirit of invention among them by degrees, before they became ſo multiplied as to threaten them with extermination. And it may be added, that when they were compelled to relinquiſh their original ſeats, they would migrate in companies, and the probability of ſuch inventions riſes with the number of people involved in the ſame neceſſity.

(*B*) The poſition of a ſingle ſexual pair of each ſpecies of animal being originally created, is not to be underſtood as if they had been formed in the ſame artificial or natural day; otherwiſe the carnivous animals, who by the ſtructure of their teeth only are capable of living upon vegetables, muſt have deſtroyed their proper prey (the future founders of ſpecific family) one day, and ſtarved the next. It is neceſſary to this Hypotheſis to conſider the animals ſubſiſting upon vegetables to have been firſt created in ſingle ſexual pairs, and to have multiplied conſiderably; then beaſts of prey: the firſt Chapter of Geneſis points out this order; we have firſt an account of the creation of Vegetables, then Cattle, next Inſects, and laſt Beaſts of the Earth, which contradiſtinguiſhed to cattle, means beaſts of prey. The beſt commentators have ſuppoſed the term

day

day to ſignify ſome determinate ſpace of time, not what we now limit it to.

(C) Dr. Black, whoſe experiments in chymiſtry have led the way to ſome of our fineſt modern diſcoveries in his Lecture upon Water, has attributed the increaſe of the earth to water being turned into earth by trituration and evaporation. As he refers expreſsly to this Eſſay, I ſhall give an extract of what he has ſaid upon the ſubject, with ſome reaſons which may be alledged for and againſt his hypotheſis, leaving the deciſion to thoſe who have leiſure to purſue theſe reſearches.

He informs us of a diſcovery of Godfrey's, "*That* "*a ſmall quantity of water rubbed in an agate mortar* "*leaves a conſiderable portion of earth behind it: Wal-*"*lerius found, that where it was thus triturated for five* "*days, one-third of the whole quantity was transformed* "*into earth: his account of this experiment is not very* "*clear, but the ſubſtance generated ſeems to have been a* "*clay.*" If this be admitted, the conſtant action of winds, tides and currents in the ocean, and the ſtreams of rivers, makes this trituration appear a very conſiderable agent in the buſineſs of tranſmuting water into earth.

Evaporation likewiſe contributes to produce the ſame change: "*Boyle relates that he evaporated a quantity* "*of water 50 times over, and every time obtained a por-*"*tion of earth; Margraff repeated the experiments of* "*Boyle*

" *Boyle with the utmoſt care and the ſame reſult: upon*
" *the application of an acid to the earth thus obtained,*
" *part of it was diſſolved, and appeared to be calcarious;*
" *another part united with alcaline ſalts, and ſhewed*
" *itſelf to be of the vitreſcent kind.-----But a friend*
" *of Mr. Boyle repeated the proceſs ſo often, that he ob-*
" *tained* $\frac{3}{4}$ *of an ounce of earth from an ounce of water:*
" *it was of a white ſparkling colour, and did not un-*
" *dergo any alteration from common heat.*"

The circumſtances attending experiments ought to be minutely deſcribed: Boyle has given us the number of times which he repeated the operation, omitting the total quantity of earth obtained; his friend, he informs us, after a number of diſtillations, got $\frac{3}{4}$ of an ounce of earth from an ounce of water, but he has not given us that number: if the account had been complete in either caſe, we might have determined the following phyſical problem; *how much is the altitude of the ſea diminiſhed every year, or every century, by its water being converted into earth by evaporation?* I ſhall ſuppoſe the repetitions in the latter experiment to have been 150; when the proper number be aſcertained by new trials, it will be eaſy to ſubſtitute it in the place of the aſſumed quantity, and correct the reſult.

If the water made uſe of be as near purity as poſſible it will be raiſed in the ſame ſtate after every ſucceſſive diſtillation, and the earth generated will be in proportion to the quantity of water remaining at the beginning of every evaporation. Le the quantitity of water uſed in the firſt

evaporation be called (q), the part of it then transformed into earth (r), the remaining water at the end of the firſt diſtillation ſhall be $\overline{q-r}$, or $\overline{q-r}^{1}$ to find the quantity of water changed into earth by the ſecond, $q : r :: \overline{q-r} : \frac{r \cdot \overline{q-r}}{q}$ the quantity ſought; and the unchanged water $\overline{q-r} - \frac{r \cdot \overline{q-r}}{q} = \frac{\overline{q-r}^{2}}{q}$ in like manner it ſhall be

	1	2	3
Diſtillation - -			
Quantity of water changed - - -	$\frac{r}{q^0} \cdot \overline{q-r}^{0} \cdot \cdot$	$\frac{r}{q^1} \cdot \overline{q-r}^{1} \cdot \cdot$	$\frac{r}{q^2} \cdot \overline{q-r}^{2}$
Ditto remaining unchanged - - -	$\frac{\overline{q-r}^{1}}{q^0}$	$\frac{\overline{q-r}^{2}}{q^1}$	$\frac{\overline{q-r}^{3}}{q^2}$

and the quantity of water remaining unchanged after 150 diſtillations will be $\frac{\overline{q-r}^{150}}{q^{149}} = A$, and $A \propto q^{149} =$ $\overline{q-r}^{150} : \frac{\text{Log } A \propto \text{Log } q^{149}}{150} = \text{Log } \overline{q-r}$ which putting $q = 100$ and $a = 25$ gives $L \overline{q-r} = \frac{299,3979400}{150} =$ 1,9959862. Whence $q-r = 99,08005$ and $r = 0,92$ or ,0092 of the quantity of water raiſed by evaporation: and taking that at $\frac{1}{10}$ of an inch every day (which appears by Halley's experiments, and ſome ſince made, to be very near

near the truth) the thickneſs of the pellicle of water transformed every day into earth upon the ſurface of a ſquare inch will be ,00092, which in a century amounts to 3 feet 3 inches Engliſh.

This would be the decreaſe of the ſea in that period, if ſuch a quantity of the water were abſolutely annihilated; but it is converted into a cruſt of earth ſubſiding and raiſing the bottom, whoſe thickneſs muſt be ſubtracted from the former decrement of 3 feet 3 inches: this will be equal in weight to the original quantity of water, and appears by experiment to be of a chalky nature: the ſpecific gravity of chalk is to that of water as 52 to 29, if equal weights of both be taken, the ſpace occupied by each ſhall be in the reciprocal ratio of theſe numbers; and the thickneſs of a ſtratum of chalk thus generated, in a century will be found equal to $\frac{29 \times 39}{52}$, or $21\frac{3}{4}$ inches, which, deducted from 39 inches, gives the decrement of the height of the ſea in a century by evaporation equal to $17\frac{1}{4}$ inches. But to get the whole decreaſe we muſt add what ariſes from trituration, as mentioned above; which though perhaps the moſt conſiderable factor, I ſee no means of aſcertaining.

Theſe obſervations likewiſe tend to confirm Newton's theory of the figure of the earth, and in return receive great ſtability from the evidence by which that theory has been confirmed: they ac-

count for the height of the earth in the equatorial parts with great ſimplicity and clearneſs. The heat cauſes greater evaporations there than in parts nearer the pole; and conſequently when the ſea uniformly covered the globe to a great depth, the earth was there depoſited in greater quantities, and there mountains and plains muſt have been extant above the ſurface of the water firſt; thus the earth obtained its oblate ſpheroidal form. This is evident from the conſideration of evaporation alone, but earth muſt have been generated alſo much faſter by the agitation of the waters the equatorial tides riſe to greater heights their fall is proportionally more; and to this we muſt add the ſtorms of the torrid zone, partly owing to the ſame cauſe, and partly to a greater difference of temperature in the upper and lower regions of the air.

But there are difficulties ſeemingly inſuperable, in accounting for the formation of the various ſtrata from theſe experiments, and the reaſonings built upon them. The ſea, upon this hypotheſis, muſt always depoſit either the ſame ſimple earth or the ſame compound; and could therefore generate no varied ſtrata, but a maſs of heterogeneous particles, uniform in its appearance, and intimately mixed, conſiſting of calcarious and vitreſcent earths, with a mixture of clay generated by the agitation of the waters. Theſe would never be found ſimple in thick ſtrata, unleſs we could ſuppoſe that evaporation were ſuſpended for ſome centuries in a given

part,

part of the ſea, while the waters by agitation alone produced a ſtratum of clay; and again that they remained at reſt for another period while a thickneſs of chalk was generated above it by evaporation; not to mention mineral and ſulphureous ſtrata.----The arguments which may be alledged on both ſides of this queſtion ſeem to have conſiderable weight, and I wiſh rather to call the attention of abler men to them, than to decide upon them myſelf.

The experiment of converting water into earth by evaporation has been repeated by ſome later chymiſts. The proportion ſo changed appears by what has been before layed down to ,0092 parts of the whole water raiſed in vapour. But Margraf, from that proceſs, obtained no more than $\frac{1}{200}$ part of that portion of Calcarious earth; the experiment therefore related by Boyle muſt have been fictious, or ſome error crept into Margraf's account.---Mar. Opuſc. t. 2. p. 25.

Waſelton aſſerts, that by keeping water in cylindrical tubes, in a moderate and equable heat, that it became earth;---but which was again diſſolvable into an imperfect mixture. This ſeems to indicate that earth may be changed into water, as well as water into earth.

We have likewiſe ſome experiments of the Abbè Fontana upon this ſubject: ſometimes the glaſs employed in them appeared to have been croded; at other times earth was generated without any ſuch appearance. He has announced his intention of repeating theſe experiments

ments upon ſo large a ſcale, as to bring this queſtion to a certain deciſion.

(*D*) Under the Equator no ſnow can lay upon the mountains unleſs at very great heights above the level of the ſea: the top of the mountain in this Paradiſiacal iſland muſt be as much higher than the Pike of Teneriffe, as the Alps are above the level of the ſea, and no ſuch mountain is known to geographers.---But admitting ſuch a one to be diſcovered, the difficulty is not removed; for let us ſuppoſe the ſeeds of its Alpine plants to be lodged upon the tops of other rocks as ſoon as they appeared above the water, being carried by the ſea winds, or any other cauſe; they muſt remain lodged there, until by the ſubſiding of the ocean, the rock becomes ſo much elevated above its bed as to be covered with perpetual ſnow: as the ſurface of the ſea falls (according to this theory) leſs than five feet in a century, ſuch ſeeds muſt lay there with their vegetable virtues unimpaired at leaſt a thouſand ages before they ſpring. As the place where they are depoſited becomes perpetually more and more elevated it is continually growing colder, their vegetable juices therefore muſt be ſuppoſed not to be put in motion or deſtroyed by the viciſſitudes of moiſture and ſuperior heat for that whole period, and only beginning to act in the regions of a polar climate at the end of that time.---Many parts of the world, as the Cape of Good Hope, produce numerous tribes of very ſingular plants; how comes it that they are not found in the intermediate tracts between the

Cape

Cape and the Paradiſiacal Mountains? in travelling along the continent they muſt have rooted, and produced ſeed from diſtance to diſtance. Many land animals alſo inhabit cold mountainous regions, ſeparated from each other, which, whether they be of the ſame, or a different ſpecies, furniſh very ſtrong objections againſt this Hypotheſis.

DISSERTATION III.

ON THE

POLICE OF NATURE.

BY

CHRIST. DANIEL WILCKE.

Amœn. Acad. vol. 6. p. 17.

SUMMARY.

SUBJECT *laws of nature to preſerve the number and proportion of the ſpecies in the Natural kingdoms*--VEGETABLE KINGDOM, *Plants, that they may not extirpate each other ſeparated by climate, ſtation, time of flowering*——*Subordination*

of plants of different claſſes in the POLICE OF NATURE.

ANIMAL KINGDOM—*Uſes to preſerve the proportion of the number of plants*——2. *ornament to the world*——3. *and* 4. *to remove ſuperfluities*——5. *to diſſeminate plants*——Examples, *worms*——*Inſects confined to feed upon a ſingle plant, exceptions, to part of a plant to keep it from extirpating others*——*many ſpecies feed upon plants untouched by cattle, deſtruction of a ſpecies of plants by the increaſe of their number prevented by their being food to other inſects*——*Clear away putrid matter.*

Fiſh *anſwer the ſame purpoſes in the waters*——Birds——Paſſeres *preſerve the proportion of inſects, ſeeds*——Gallinæ *and others devour ſuperfluous ſeed and diſſeminate many ſpecies*——Grallæ *keep under the multitude of worms, inſects and amphibia*——Anſeres, *frogs, gnats, and*

and fiſh——Picæ, *worms and inſects* Accipitres *chief food carrion, ſome birds* ——Mammalia *of the waters, fiſh*—— Cattle *clear the earth for new vegetation* ——*ſome beaſts bury ſeeds*——Feræ *clear away dead carcaſes*——Bruta, *inſects and plants*——*on* Man.

RECAPITULATION, *conſequences of the deſtruction of one ſpecies of prey fatal, minuteneſs of ſome animals final cauſe, ſmalleſt animals moſt difficult to extirpate, number of young in a year diminiſhes with their longevity.*

CHAPTER I.

§ 1. 2.

* * * "THOSE laws of nature by "which the number of ſpe- "cies in the natural kingdoms is preſerved "undeſtroyed, and their relative propor-

" tions kept in proper bounds, are ob-
" jects extremely worthy of our atten-
" tive purſuit and reſearches:" in this inveſtigation we muſt proceed from her ſimple to her more complicated inſtitutions: the circumſtance of my having no predeceſſor in this enquiry, will, I hope, be received as a ſufficient apology for venturing upon ſuch an attempt, and for my deficiences in the execution of it. Entirely omitting the foſſils, I ſhall endeavour to develop ſome of the conſtitutions eſtabliſhed for this end in the animal and vegetable kingdoms.

§ 2.

VEGETABLE KINGDOM.

If the many thouſand ſpecies of vegetables grew together in one and the ſame place, ſome would infallibly predominate over and extirpate others; here we diſcover the moſt manifeſt tokens of the di-

vine

vine wiſdom; they are ſeparated into different parts of the world, ſome being natives of India, ſome of the temperate Zone, and others of the Polar circle. In every country different ſpecies have different ſtations aſſigned them, growing in the ſea, lakes, marſhes, vallies, fields, hills, rocks and ſhaded places, and every one has its different ſoil, ſand, clay, earth, or chalk, allotted to it: as for example, Sweden produces about 1300 different plants; theſe being each confined to their proper ſtations, there are ſeldom above 50 or 100 to be found in a given place; by which it happens that no one can totally exclude another. Every plant flouriſhes beſt in its own ſtation; if it intrude into another it is choaked up by the native ſpecies, and becoming unhealthy is at laſt totally devoured by the Aphides* and other inſects. And that theſe 100 ſpecies may be the leſs liable to oppreſs one another, ſome of them have their time

* Lice in the leaves of plants.

time of flowering in the Spring, ſome in Autumn and others in Summer.

§ 3.

Nature has eſtabliſhed a ſubordination and the appearance of Police in their ſeveral tribes. Among theſe we may conſider the *Moſſes* as the poor laborious *peaſants*, occupying the moſt barren tracts of the earth which they cover and mollify; and dedicating their ſervices to the other plants, that their roots be not deſtroyed by the heat of the ſun or the rigour of the froſt: thoſe unfertile tracts are allotted to them which their fellow citizens do not think worth occupying.

The *Graſſes* are the *Yeomanry* of the vegetable kingdom; they cover the greateſt part of the ſurface of the earth, and the more they are trodden under foot and oppreſſed, the more they extend their roots

roots and endeavour to increaſe; their multitude forms the ſtrength of the ſtate.

Herbs may be looked upon as the *Gentry*; the luxuriance of their foliage, the ſplendor and beauty of their flowers, their ſmell, taſte and figure, give a kind of dignity to the vegetable community.

The *Trees* are to be eſteemed the *Nobility* of this ſtate, they are deeply rooted, elevate their heads above their fellow-citizens, and protect them from ſtorms, heat and cold. There are likewiſe ſome claſſes of vegetables which have a ſpecies of chartered rights granted them by nature, a kind of excluſive privilege in their ſtation that no other plants can make a forcible entry upon them, or if they do, they eaſily expell the invaders: thus the Ranunculus ficaria*, the Allium urſinum†, and the Senecio ſaracenicus‡ maintain their ſituation

* Leſs celandine. † Ramſon.
‡ Broad-leaved Rag-wort.

tion under the lower ſhrubs, and exclude all other plants; the Avena pratenſis*, when it gets footing among the juniper, totally baniſhes it; the Erica† will never approach to the beach nearer than the extent of its boughs: ſome plants put on quite a military appearance, armed with ſpines, thorns and hooks, as the thiſtle, the furze, the Berberis and innumerable others, to protect the herbs which grow under them from cattle; and ſome are nurſed by other vegetables being unable to ſubſiſt or to flouriſh vigouroufly upon the earth, as the Viſcum‡, the Epidendron, § Cuſcuta and many more.

§ 4.

By this inſtitution the ſeveral vegetables are preſerved in their proper limits; and though their ſpecies amount to many thouſands,

* Meadow oat-graſs.
† Ling.
‡ Miſletoe.
§ Dodder.

thouſands, the number found upon one ſpot is very ſmall.

§ 5. *omitted.*

The ANIMAL KINGDOM.

§ 6. *extract.*

* * * * The general received opinion has been that vegetables were created for the food and uſes of animals; but attending to the order of nature, we diſcover that animals were created upon account of plants. * * * *

§ 7.

Animals ſerve in the firſt place to preſerve a due proportion among vegetables: 2dly. to adorn the theatre of nature and conſume every thing ſuperfluous and uſeleſs:

leſs: 3dly. to remove all impurities ariſing from animal and vegetable putridity; and laſtly, to multiply and diſſeminate plants and ſerve them in many other reſpects.

§ 8.

Worms firſt offer themſelves to our conſideration; but as far the greater number of theſe are natives of the deepeſt parts of the ocean, which oppoſes an invincible obſtacle to our inveſtigating their natural hiſtory, I am obliged to paſs this diviſion of my ſubject over untouched.

§ 9 and 10.

The Inſects are the moſt numerous tribe of the miniſters of nature, the multitude of their ſpecies ſeems to vye with that of plants. * * * Some of theſe are always found adhering to vegetables, and ſubſiſt upon them totally when in the

the ſtate of Caterpillars; ſuch are the Papiliones*, Chryſomelæ†, Aphides‡, Cicadæ§, and a long catalogue beſides. It is almoſt impoſſible to find a plant not expoſed to the ravages of ſome of theſe, yet they are all confined to their diſtinct ſtations in the ſame manner as vegetables; this is proved by innumerable examples in the Pandora inſectorum. Every one of theſe has the care of a ſingle plant aſſigned to it, which when it cannot procure, there are a few others which it preys upon by neceſſity, to preſerve life and perpetuate the ſpecies, till a new ſupply of its more proper and natural food ſprings up. The Silk worm feeds upon the leaf of the mulberry, but when it cannot be obtained in ſufficient plenty, it ſubſiſts upon the Letuce and the leaves of ſome trees; but the diminution of its beauty, ſize and vivacity, and the inferior quantity and quality of its ſilk clearly

 point

* Butterfly.
† Gold-chaffer.
‡ Leaf-louſe.
§ Graſshopper.

point out that ſuch food is by no means well adapted to its nature. The leaves of a given plant are ſometimes the food of one inſect, the flowers, the ſeed veſſel, and ſeed, of ſo many others; thus the Tenthredo ſcrophulariæ* devours only the leaves of that plant, the Curculio ſcrophulariæ† its fructification; the Curculio nucum‡ the kernel of wood nuts, and the Phalæna ſtrobilella the cones of the fir.

§ 11 and 12.

Every plant has its proper inſect allotted to it to curb its luxuriancy, and that it ſhould not multiply to the excluſion of others, and when the inſect is well ſupported by the diſcharge of his commiſſion, he lives plentifully and propagates a numerous offspring, but by the failure of his work he languiſhes and dies. Thus graſs in meadows ſometimes flouriſhes

* Berk. 163. 4. † Figworth wevil.
‡ Nut-wevil.

flouriſhes ſo as to exclude all other plants: here the Phalæna graminis, with her numerous progeny, find a well ſpread table; they multiply in immenſe numbers, and the farmer for ſome years laments the failure of his hay crop; but the graſs being conſumed, the Phalænæ die with hunger, or remove to another place. Now the quantity of graſs being greatly diminiſhed, the other plants which were before choked by it ſpring up, and the ground becomes variegated with a multitude of different ſpecies of flowers: had not nature given a commiſſion to this miniſter for that purpoſe, the graſs would deſtroy a great number of ſpecies of vegetables of which the equilibrium is now kept up. The Scrophularia* is eaten by very few cattle, it affords food to a number of ſpecies of inſects: ſcarce any beaſt will touch the nettle, fifty different kinds of inſects are fed by it; ſome of which

* Figwort.

which ſeize upon the root, while the ſtem, leaves, flowers and ſeeds, are eaten by others; without this multitude of enemies it would annihilate a great number of plants: The ſame holds good in ſhrubs and timber trees, eſpecially thoſe which produce ſpines, and are eaſily diſſeminated; the loftier plants are ſo much the more preyed upon by inſects, as they are leſs expoſed to the attacks of cattle: and inſects appear to be created to reſtrain the different ſpecies of vegetables within proper limits.

§ 13.

But the avidity with which they execute this commiſſion might degenerate into an abuſe, which would terminate in the utter ruin of their ſubject vegetables, if they were permitted not only to reſtrain its exceſs, but totally to annihilate a ſpecies: the Oeconomy of Nature has there-

therefore ſubjected them to certain moderators, that they may increaſe but not indefinitely. Thoſe inſects which ſubſiſt upon plants have others ſet over them, who devour their ſuperfluous numbers; theſe, like all carnivorous animals, deſtroy a great number of individuals for their ſupport, they abound moſt where their prey is in the greateſt quantity, and exerciſe their force where it is moſt wanted. Where the Aphides* find a a plant ſickly, they almoſt cover the leaves and branches; here the Muſca Ribeſii, Pyraſtri†, and others of the ſame family aſſemble and depoſit their eggs, which are ſcarce hatched, and acquire motion before they totally deſtroy the Aphides‡; they are likewiſe joined in this work by the progeny of Coccionella, Hemerobius§, and the Ichneumon aphidum‖.

* Leaf-louſe.
† B. 174. 7.
‡ Leaf-louſe.
§ Golden eye.
‖ Leaf-louſe ichneumon.

§ 14.

§ 14.

The Phalæna ſtrobilella has the fir cone aſſigned to it to depoſit its eggs upon; the young caterpillars coming out of the ſhell conſume the cone and ſuperfluous ſeed; but leſt the deſtruction ſhould be too general, the Ichneumon ſtrobilellæ lays its eggs in the caterpillar, inſerting its long tail in the openings of the cone till it touches the included inſect, for its body is too large to enter; thus it fixes its minute egg upon the caterpillar, which being hatched, deſtroys it. But leſt it ſhould multiply to the total extermination of the former ſpecies, the Ichneumon moderator, a very ſmall inſect enters into the cone, and lays its eggs upon the caterpillar of the Ichneumon ſtrobilella, which being hatched, devour it: we owe this diſcovery to D. Rolander.

§ 15.

§ 15.

The Caterpillars of the Phalænæ, which ſubſiſt upon trees and herbs, have alſo other inſects ſet over them; the Carabi* get by night upon the branches of the trees, and devour what caterpillars they find, as Reamur informs us: thoſe who raiſe fruit trees cannot practice a better expedient to free themſelves from caterpillars, than to collect thoſe inſects, and place their eggs at the foot of the tree; which being hatched will execute their office in the Police of Nature, and devour them.

§ 16.

Wherever any putrid matter is collected, certain inſects are gathered together by it, whoſe brood devour it, and preſently purify the place: Gnats drop their eggs over impure and putrid water,

* Species of Beetle.

the Muſca putris* in mire, the Muſca domeſtica‡ in dunghills, and others in dead carcaſes: but leſt theſe ſhould multiply beyond proper limits, ſome vigilant overſeers are appointed over them; the Spider weaves innumerable webs upon every buſh, the Aſili† ſuck their blood, and the Dragon fly catches them wherever he flies.

§ 17.

Thus hundreds and thouſands of ſeparate commiſſions are given to different animals, that the general proportion of things ſhould be kept up; and nothing be multiplied beyond it: Every created thing has a ſuperior and a ſubordination appointed it.

* B. 176. 17. ‡ Houſe-fly.
† Hornet-fly.

§ 18.

Fiſh in the waters partly ſubſiſt upon plants, partly by prey; thoſe devour aquatic vegetables, theſe the worms and inſects they find there: but leaſt they ſhould be entirely extirpated by them, there are fiſh of prey who thin the inhabitants of the waters, and harraſs their numerous ſhoals. The ſmaller fiſh would be able to avoid them by turning frequently, and the excellence of their fins, if their number did not hinder their eſcape. Thoſe which do not multiply in in that abundance, are armed with ſpines to keep off their enemies. The bodies of dead fiſh in the bottom of the water are perforated by eels, and devoured by the Myxinæ, beſide crabs and ſome inſects; ſo that here likewiſe we ſee the greateſt attention employed to preſerve purity as well as proportional number.

* B. 191.

§ 19.

The number of Amphibious animals is leſs than that of the former claſs, yet every one has his diſtinct province aſſigned him: the Frogs remove all thoſe ſuperfluities which ſwarm upon the ſurface of our waters and wells, as the Duck-weed: and thoſe ſmall worms which change into Gnats; Serpents and Lizards prey upon inſects, the Squali* and Rajæ‡ devour dead bodies at the bottom of the ſea.

§ 20.

The Birds, whoſe tribes are ſo numerous, have all their peculiar diſtinctions and offices in the Police of Nature.

§ 21.

The numerous genera of the Paſſeres§ feed chiefly upon inſects, and as theſe moſtly

* Shark genus. ‡ Skate. § Order 6.

moſtly abound in trees, they fly thither in great flocks; if they do not thus obtain a ſufficient proviſion, they ſeek their food elſewhere: ſome of them pick up ſuperfluous ſcattered ſeeds; the Starling lives upon earth worms, the Goatſucker upon moths, the Parus* different ſpecies of gnats: And as inſects generally die at the end of Summer, theſe birds either hide themſelves in ſome retreat during winter, or migrate into other regions. Thoſe who live indifferently upon ſeeds and inſects, make ſhift to pick up a ſcanty living in Winter with us until the return of Spring.

§ 22.

The Gallinæ † and doves feed upon ſuperfluous ſeeds; the Turdi‡ ſearch for the ſpot where there is the greateſt quantity of berries; and if they devour them in too great quantities, many paſs through them

* Tit-mouſe. † Order 5.

‡ The Black-bird, the Miſſel-bird, and others of this genus.

them undigeſted and fertilized: the Alaudæ*, who pick up ſuch a variety of ſeeds, diſſeminate likewiſe a great number, and often leave them where we wonder to find them ſpontaneous: this was the cauſe of oats ſpringing up in fields ſown with rye, which in our age had almoſt perſuaded all Europe to believe in the tranſmutation of corn.

§ 23.

The Tetraones† and Peacock feed their young with inſects, hence the former ſeek our Northern countries in flights, where the innumerable quantity of gnats enables them to find their young a plentiful ſubſiſtence; theſe inſects are thus prevented from periſhing without a uſe.

* Lark. † Moor game.

§ 24.

§ 24.

The Grallæ* perform their taſk in lakes and pits, where myriads of inſects, aſcarides and worms, are continually employed in removing all impurities; by the aſſiſtance of theſe birds, a due proportion is kept up among them: in Summer, when the marſhes are dried up in hot climates, they migrate to us; but the ice locking up the waters when Winter ſets in, and depriving them of their food, they are obliged to return into the ſouth: the Nile, which before had covered over the face of Egypt, retreating, a number of Amphibious animals are left upon the the earth; the ſtorks reſort there at that ſeaſon, whoſe principal food is amphibious animals and ſerpents.

* Order 4.

§ 25.

§ 25.

The Anſeres* and Anates† receive their commiſſion from nature to clear the waters of all ſuperfluities, and devour the brood of frogs and gnats; the Mergi‡, Alcæ§, Colymbi‖, Lari¶ and Sternæ**, prevent fiſh from multiplying to exceſs; the Diomedeæ, the Pelicans and Phaëthontes inhabit the ocean; they hover in flights over the flying fiſh, their proper prey, when they are purſued by the Corypheni.

§ 26.

It is the buſineſs of the Picæ to clear the earth by picking up the worms and inſects; the Buceros and Corvus corax†† devour

* Order 3.
† Ducks.
‡ Divers.
§ Awks.
‖ Guillemots.
¶ Gulls.
** Terns.
†† Raven.

devour carion, the Graculus*, Crotophagus and Cuculus† many inſects, the Certhia‡ feeds upon their eggs; the Tipula‖ feeds upon the roots of Graſs, and leaves the ſtalk ſtanding, which thus prevents any future vegetable from occupying its place; the Crow, who is exceedingly fond of the caterpillar of the Tipula, is obliged to dig up the dead ſtalks to come at them, and thus performs the taſk aſſigned to her.

§ 27.

The Accipitres find their appointed food in dead bodies, but when this proviſion fails, they (but with greater difficulty indeed) ſubſiſt upon ſuperfluous birds. The Lanii§ are employed in diminiſhing the number of beetles. All birds promiſcuouſly are not the prey of the ¶Accipitres

* Corniſh cough.
† Cuckow.
‡ Creeper.
‖ Berk. 171.
§ Butcher bird.
¶ Hawk genus.

cipitres, their mode of flight protects a great many. The principal food of the Buteo* is the toad; ſome prey only on the Doves, others on Domeſtic fowl, the Stork or the Sparrows; the Halietus† ſeizes the largeſt fiſh, the Perinopterus, Papa, Aura and Harpya, ſcarcely touch any thing but dead carcaſſes, and therefore are very ſlow in flight; the Owl deſtroys the ſuperfluous bats, mice, hares and the nocturnal mammalia, beſide moths.

§ 28.

The Mammalia are fewer in number, but more vigorous in their operations.

§ 29.

The Cete‡, with the Phocæ§ and Lutræ‖, are the rulers of the waters, and ſubſiſt

* Buzzard. † Oſprey. ‡ Order 7.
§ Sea calf. ‖ Otters.

ſubſiſt by repreſſing the too great abundance of their inhabitants.

§ 30.

The Pecora and Belluæ* every year devour the herbs that the face of the earth may be cleared for its annual renovation: certain ſpecies of vegetables ſeem interdicted to certain animals, leaſt other ſpecies who follow them ſhould be totally deprived of ſubſiſtence.

§ 31.

The Glires† have it aſſigned to them in office to gnaw away and conſume all ſuperfluous and dead ſubſtances, having a diſagreeable appearance; the Squirrel is as great a devourer of the cones of pines, as the Loxia curviroſtra‡ and Coccothrauſtes§, which ſcattering their ſeeds, ſubſiſt upon

* Order 5. and 6.
† Order 4.
‡ Croſs bill.
§ Haw finch.

upon their ſuperfluous parts: the Squirrel, together with the Mouſe, the Corvus caryocatactes* and Glandarius†, after they are well fed, collect and bury nuts and acorns in the earth, where they are frequently left either by their forgetfulneſs, being driven from their old haunts, or by death; thus theſe ſeeds which perhaps would never have been buried a proper depth in the earth to vegetate, ſpring and grow up into trees.

§ 39.

The Beſtiæ‡, as the Sus¶, Naſua, Erinaceus§ and Talpa‖, in their ſearch after worms and roots, turn up the earth, and thus prepare it for the reception of ſeeds.

* Nutcracker.
† Jay.
‡ Order 2.
¶ Swine.
§ Hedge-hog.
‖ Mole.

§ 33.

The Feræ* are employed in taking away dead carcaſſes from the ſurface of the earth, and hence they are aſſembled at places where they abound, but accompanied by the Falcon, the Vulture, the Owl and the Crow, and other birds deſtined to the ſame ſervice; being all drawn together by the putrid ſcent of their prey: the wildeſt beaſt never deſtroys another but through neceſſity.

§ 6.

The Bruta, as the Elephant, the Sloth, the Ant, Bear and the Manis, together with ſome animals of the claſs of the Primates†, as the Monkey, and the ſwarms of Indian bats inhabit the lofty woods of of thoſe countries, which cover the herbs below

* Order 2. † Order 1.

below as it were with one continued roof, leſt they ſhould be totally parched up by the heat of the ſun: part of theſe, as the Bat, Ant eater and Manis, ſuſiſt upon thoſe inſects which are moſt numerous; and others, as the Elephant, Monkey, Lemuris and Sloth, upon the fruits and luxuriant foliage of trees.

§ 35.

Man is the laſt and higheſt miniſter of Nature, to whoſe uſe and convenience every thing is ſubſervient; and he in many inſtances ſerves to keep up her inſtituted proportions: the greateſt whale in the ocean, the moſt ferocious lion or tyger on the land, falls a victim to his boldneſs and addreſs. He accommodates to his uſe herbs, trees, fiſh, birds, and every thing ſuperfluous in the ſyſtem.—Thus an exact equilibrium is kept up, where nothing is redundant or uſeleſs.

But

But man himſelf is ſubject to this general inſtitution; in places abounding with inhabitants, contagious diſorders prevail with more frequency and force, and I do not know whether it be not a poſitive conſtitution of nature, that wars ſhould be moſt common where men are found moſt numerous.

CHAPTER II.

FROM the examples above laid down, we diſcover the following laws in the Police of Nature.

Vegetables which are ſo many proofs of the wiſdom of the great Creator, are deſtined always to preſerve their number of ſpecies. To obtain this end, generation, nutrition and proportion are neceſſary.

Animals

Animals ſeem created to aſſiſt in effecting theſe three purpoſes.

They aſſiſt in the generation of plants by cropping them down, and preventing a ſterility, which might be the conſequence of too much luxuriance: they likewiſe admirably contribute to their diſſemination, and many of them dig up the earth for the reception of their ſeeds. Birds and cattle carry many of them to diſtant places where they never ſprung before, to omit thoſe which, after having ſatisfied their hunger, hoard what remains of their ſtore in the earth: their dung likewiſe ſerves to the ſupport of vegetables.

Their proportion ſeems to be among the moſt wonderful inſtitutions of nature; animals ſeem to be the principal Miniſters ſet over them by her to take care that of the many ſpecies of vegetables, no one ſhould be totally extirpated: the

the ſubordination of animals, obſerved before, greatly aſſiſts to this end.

From the parts of Natural Hiſtory already known, we may form a judgement of the importance of every one of the conſtitutions of nature; if the ſpecies deſtined to prey upon any particular animal were to periſh, the greateſt calamities might reſult from it: Nature has appointed the Quiſcula to watch over the Dermeſtes piſorum*, theſe being extirpated in North America by ſhooting, the peas have been totally ruined. If all the Sparrows were to be deſtroyed here, our plantations would be ruined by the Gryllit†; America, deprived of Swine, would be infeſted with ſerpents to an intolerable degree; and we muſt believe the ſame with reſpect to the other ſervants of the Great Family of Nature, ſince its Author has permitted nothing to be without ſufficient reaſon.

* Pea dor. † Cricket.

Very manifeſt indications of the wiſdom of nature are to be gathered from the ſize of ſome animals being reſtrained in given bounds; if the Cicindela*, the Libellula†, or the Scolopendra, had been created equal in magnitude to a Lion, the whole human and animal race muſt have been deſtroyed.

One circumſtance which ſerves to preſerve the general proportion deſerves our higheſt admiration, that the leaſt animals are propagated in the greateſt numbers, and are with the moſt difficulty totally extirpated: it admits no doubt that a ſingle ſpecies of inſects, though of the ſmalleſt ſize, can commit more ravages in a village than an Elephant; the whole ſpecies of ſuch inſects cannot be extirpated, the Elephant may be killed by a ſingle ſhot.

The long lived animals propagate very ſlow; the claſs of Hawks lay but four eggs

* Meadow wig. † Dragon fly.

eggs in a year, the Domeſtic fowl from thirty to fifty, Doves two every month; the Hare has young often in a year, and a Bee in the ſame period will lay 40,000 eggs.

The higher miniſters of nature, the animals of prey, are ſlower and more indolent than others, and never ſeek their prey but when urged by hunger; as we obſerve in Lions, Tygers and Eagles.—Beaſts of prey, when they can get no dead carcaſſes, find conſiderable difficulty in getting food; and they catch generally only ſuch of the other animals who are infirm with age or diſtemper; thoſe which are young and healthy eſcaping them by running, flying, ſwimming, or in ſome other mode.

There are ſome animals likewiſe in the Police of Nature who are appointed as watchmen to warn other animals of their danger, as the Charadrius ſpinoſus, La-

nius*, Grus†, Meleagris, and others, which give notice to the birds of a hawk being out in ſearch of prey: nor would the larger conchs ever eſcape the Sepia loligo‡ unleſs they had the Cancer pinnotheres as a guard. Thus we ſee Nature reſemble a well regulated ſtate in which every individual has his proper employment and ſubſiſtence, and a proper gradation of offices and officers is appointed to correct and reſtrain every detrimental exceſs.

* Butcher bird. † Crane. ‡ Sea ſleeve.

NOTE.-----I have taken the ſame liberty with this Eſſay as with ſome others, in omitting ſome very conſiderable paſſages in it. The reaſons which in general have determined me to this are explained in the Preface.

The care which Nature is evidently ſeen to take in many inſtances to preſerve different ſpecies of the Animal and Vegetable kingdoms from being totally extirpated,

pated, and to keep up a relative proportion in their numbers, renders it extremely probable that it is her general deſign. Thoſe parts of the original Eſſay which tend to prove this are retained here.

But there is a ſecond point which our author labours to eſtabliſh; that Vegetables were not created for the uſe of animals, but animals to preſerve the number and proportion of the ſpecies of plants. He has ſupported this new opinion more like a Rhetorician than a Natural Hiſtorian. I have contented myſelf with leaving the ſimple propoſition in the text, omitting the proofs upon which it is founded. But to gratify the curioſity of the reader as to the mode in which the ſubject is treated, I ſhall in this Note extract and put together his Argumentum Achilleum: "*Plants are* "*devoured by animals*; *but I can diſcover no reaſon to* "*ſuppoſe that Sheep were created for Wolves, Horſes* "*for Tygers, Oxen for Lions, or Doves and Peacocks,* "*for filthy, ſtinking Hawks and Kites, which are not* "*good to eat-----nor can we ſay that plants exiſt for* "*thoſe animals which prey upon them*; *does the Peaſant* "*exiſt for the Conſtable, the Conſtable for the Juſtice of* "*Peace, or the Juſtice of Peace for the Lord Lieute-* "*nant?*" Excluſive of this unlucky propoſition, this eſſay gives a very ingenious and enlarged view of one part of the ſyſtem of nature; and proves, by a well ſelected variety of inſtances from Natural Hiſtory, that the apparent ſcene of carnage carried on in nature by animals of prey, is not only ſubſervient, but of abſo-

lute

lute neceſſity to the preſerving of the order of things in that perfection in which it was created; and which ſubſiſts alone by maintaining the number of ſpecies, and the relative proportion of the individuals of each unaltered.

ZOOLOGICAL DISSERTATIONS.

DISSERTATION IV.

On the Rhendeer, by Cha. Fred. Hoffberg, of Stockholm.

Amœn. Acad. vol. 4. p. 144.

SUMMARY.

PREFACE. *Compariſon of extreme hot and cold climates for ſuſtaining human life ——inhabitants of both ſubſiſt by paſturage——ſtate compared with that of the farmer——Herds of the Laplander*

RHEN-

RHENDEER——*name and ſynonymes of the Rhendeer*——GENUS——SPECIES *ſpecific marks not eaſily definable*——NATIVE PLACE *Northern parts of America, Aſia, and Lapland*——*Lapland in two diviſions, Alpine and Woodland*——*The face of theſe diviſions deſcribed*——FORM *of the animal deſcribed, Scheffer and Hulden cenſured*——*Wild Rhendeer larger than the tame*——FOOD *Rhendeer Lichen*——*luxuriant where a foreſt has been burned down*——*covered over with ice when winter ſets in with rain, and the Rhendeer ſtarved*——*conſtant attendance upon them*——*Condition of the Laplander*——LAPLAND *inhabitants*——*Mountaineers, Woodmen, Mendicants a mixed race*——*Mountaineers comparatively rich chearful*——*Woodmen poor, ſolitary, melancholy*——GNATS *greateſt evil of the Laplanders*——*generation*——*multitudes of birds prey upon them*——*reaſon of their ſeeking this climate in Summer*——*breeding*

ing and food——ſupport the Laplanders in Autumn——fiſh multiplied by feeding on the Gnat in its vermicular ſtate——they infeſt the Rhendeer in the plains, few in the Alps——THE GAD FLY——*drops its egg on the back of the Rhendeer——worm eats into its back, comes out near the back bone, cauſing ulcers——drives the animal from his feeding places to the rocks*——MILK *thin, taſtes like tallow——food prepared from it of various kinds*——PROPAGATION——*caſtrated males for labour*——AGE *at moſt ſixteen years——Fable of the longevity of ſtags cenſured*——USE——*fleſh eaten——cloaths made of their ſkin——Lapland cookery——fat ſingular ſtructure——Rhendeer a ruminating animal*——DISTEMPERS——NAMES——*Laplander gives the Rhendeer proper names——Ariſtotle cenſured----what labour the animal can perform*——WILD *twice as large as the tame*——CONCLUSION.

INTRODUCTION.

THERE are very few climates ſo ſubject to the exceſs of heat or cold as to be incapable of ſuſtaining human life.——The vaſt deſarts of the torrid Zone, although they are not able to produce either fruit or corn, being burned up for want of water, yet are not ſo barren as to hinder the ſhepherd from feeding his flocks there: and although the natives of the North, or thoſe in the Alps, even in the hotteſt countries, are incapable upon account of the ſeverity of the cold in the tracts they inhabit, to produce fine crops, or gather a liberal harveſt into their barns, they apply themſelves ſucceſsfully to paſturage, and ſubſiſt upon their flocks. It would be difficult upon an accurate ſurvey of the two ſtates of ſociety reſulting from the two extremities of climate to pronounce which is the happieſt; thoſe who live perpetually

ally expoſed to the heat of a vertical ſun, or thoſe who are buried in deep ſnows and ſurrounded by perpetual froſt. The inhabitants of the regions which produce the grape and olive affect to conſider them both as unhappy: but it ſeems to me very difficult to balance the leiſure and tranquillity of the paſtoral life, againſt the perpetual labours and exertion of the farmer, with ſo much preciſion, as to make it evident to which the preference is due. Admit the ſhepherd to be lean, the farmer fat; yet the firſt is the free diſpoſer of his own actions, the laſt bears daily the yoke of ſervitude, and is deſtined to an annual renovation of the ſame ſeries of labours. Look into the immenſe detail of the works of agriculture occupying the whole year, and the various miſcarriages or misfortunes which attend the farmer in every part of it: the caſe is far otherwiſe with the ſhepherd, who wanders where he pleaſes, without drudgery or the labours of the plough.

All his taſk is to lead his flock out to the moſt fertile paſtures, and enjoy the pleaſures of a life of eaſe. Thus having no appetites to ſatisfy, he ſpends his life in tranquillity, while the farmer is continually weighed down with anxiety and trouble. It is for this reaſon that the ancients aſſigned the ſhepherd ſtate to the Silver or happier age of ſociety.

The only herds poſſeſſed by the people who inhabit the moſt inclement countries of the North, are thoſe of Rhendeer: they form their total riches and ſubſiſtence, and are the only object of their attention. To eſtimate the happineſs of which this climate and its inhabitants are capable, the nature and hiſtory of this animal muſt be known to us, which is very rarely found in the Southern parts of Europe, or even in Sweden. My attachment to Natural Hiſtory in general, and Zoology in particular, has induced me to give a deſcription of this animal, in which

I ſhall

I ſhall not content myſelf in retailing the imperfect accounts of Scheffer, and other hiſtorians of Lapland: Linnæus, in the Flora Laponnica, has many very intereſting particulars upon this ſubject, as alſo in the Journal of his Tour in Lapland, yet unpubliſhed; which manuſcript, with the moſt communicative politeneſs, he indulged me with the uſe of, for the purpoſe of making ſuch extracts as might be of ſervice to me: I have incorporated his obſervations with thoſe I had myſelf made upon the ſame ſubject. If that conciſe Hiſtory of the Elk which Leopold lately favoured the world with was received with approbation by the Natural Hiſtorian, I hope he will not be diſpleaſed with my adding that of an animal ſo nearly related to it.

NAME.

NAME.

§ 1. The Rhendeer, in ancient writers, is called Rangifer and Tarandus: its Synonymes are

Cervus; with branched round horns: their ſummits palmate. Faun. Suec. 39.
Rangifer—Geſn. quadr. 130——Olear. mus. 16. t. 10. f. 3.
Cervus rangifer, Raj. quad. 88.
Rangifer & Tarandus Charl. onom. 9.
Tarandus—Aldr. biſulc. 859.
Cervus palmatus—Jonſton. quadr. t. 39.
mirabilis —— -- t. 36.
Tragelaphus —— —— t. 34.
Hippelaphus —— —— t. 34.
Sweden. Rhen——Lapland Boetſoi.
England Rhendeer.

GENUS.

§ 2. There can be no doubt entertained that the Rhendeer ought to be referred to the Genus of the Stag (Cervus): its want of

of the primary teeth in the upper jaw evidently point out that it belongs to the Pecora*.—Its horns grow up in the figure of a polype, having their extremities at firſt ſoft, totally covered with a hairy ſkin which falls off as the horns grow hard, which are dropped and ſpring again every year, theſe marks are ſufficient to eſtabliſh the cloſe affinity of the Rhendeer and the Cervus.

SPECIES.

§ 3. This ſpecies is with difficulty diſtinguiſhed from the others of the ſame genus: it has hardly any well defined mark upon which to found a ſpecific difference, except what is taken from the ſtructure of the horns. Both the male and female Rhendeer are furniſhed with them, when in the reſt of the European ſpecies of the ſtag, the female is generally without them. The leading ſpecific mark of difference in the Rhendeer conſiſts in its branching horns not having their

* Claſs 1. ord. 4.

their trunks compreſſed as in the fallow deer, but with their ſummits only palmate; and that their bottom branch, which projects forward over the forehead, is palmate and compreſſed into branches.

NATIVE PLACE.

§ 4. The Northern parts of Aſia, and perhaps America and Lapland, in Europe, are the native places of this animal. Lapland is divided into two tracts, called the Alpine and Woodland country. Thoſe immenſe mountains called in Sweden Fjellen, divide that country from Norway, extending towards the White Sea as far as Ruſſia, and are frequently more than twelve miles in breadth.——The other, called the Woodland diviſion, lies to the Eaſt of this, and differs from the neighbouring provinces of Norway by its ſoil, being exceedingly ſtony and barren, thickly covered with one continued tract of

of wood of old pine trees: this tract exhibits one very ſingular appearance; the trees above are covered over with great quantitities of a black hanging Lichen, growing in filaments reſembling locks of hair, while the ground beneath appears like ſnow, being totally covered with white Lichens. Between this wood and the Alps lies a region called the Woodland, or Deſart Lapmarc, of thirty or forty miles in breadth; of the moſt ſavage and horrid appearance, conſiſting of ſcattered, uncultivated woods, and continued plains of dry barren ſand, mixed with vaſt lakes and mountains. When the moſſes on part of this deſart tract have been burnt either by lightning, or any accidental fire, the barren ſoil immediately produces the white Lichen which covers the lower parts of the Alps. The Rhendeer in Summer ſeek their higheſt parts, and there dwell amidſt their ſtorms and ſnows; not to fly the heat of the lower region, but to avoid the Gnat and

Gad fly: In Winter theſe intenſely cold mountains, whoſe tops reach into the higher parts of the Atmoſphere, can no longer ſupport them; they are obliged to return to the deſart, and ſubſiſt upon the Lichens.

DESCRIPTION.

§ 5. The tame Rhendeer, at the extremity of his back, is generally an ell and half high, the length from his horns to his tail two ells, from the navel to the back bone he meaſures three quarters of an ell.

When he caſts his hair, his colour is at firſt of a browniſh yellow, but as the dog days approach it grows whiter, and at laſt becomes almoſt totally white. The part round the eye is always black; the hair underneath the neck is the longeſt of the whole body; his mouth is white, as alſo his tail and the parts near it; the feet,

feet, at the inſertion of the hoof, are ſurrounded with a white ring; the hair on his body is ſo thick that it is impoſſible to put it on one ſide ſo as to ſee the naked ſkin, for which reaſon it neceſſarily ſtands erect, as in other animals of the ſame genus, but much thicker; it falls off every year, not coming away with the root, but breaking at the baſe, which is brittle.

Its horns are an ell and quarter long, beginning to curve back in the middle; cylindrical, with a ſhort branch behind, compreſſed at the top and palmated with many ſegments. A ſingle branch, or ſometimes, but very ſeldom, two ſpring out of each horn before, very near the baſe, frequently equal the length of the head, compreſſed at the top and divided into branches. The diſtance of the tips of the horns is equal to their length. The horns of the female are of the ſame ſtructure with thoſe of the male, but

leſs, more ſlender, and leſs branched.---- The horns which firſt begin to bud in the Spring are ſoft like a polype, and covered with a hairy ſkin like the reſt of the body. Their growth is not from the baſe as in other beaſts, but by the elongation of their tops. Their internal conſtruction is cellular, the cavities being filled with blood; and their extremities are ſo exquiſitely ſenſible as not to bear the ſlighteſt touch: but about Autumn, before the time of copulation commences, the horns grow hard, and the cuticle coming off, they make their appearance. About the end of November, when the time of copulation is over, the male loſes his horns.

The female keeps her horns till ſhe brings forth: but if barren, drops them in the beginning of November.

The Rhendeer, if caſtrated, ſeldom ſheds his horns till the new year: the ſtrongeſt

ſtrongeſt ſhed them ſooneſt, and the longer they keep them the worſe they are. From this circumſtance the Laplander judges of their ſtrength and health.

The aſſertion of Scheffer and Hulden, that the caſtrated Rhendeer never loſes its horns, is an evident error; as alſo their burying themſelves in the deepeſt retirement of the woods after they have loſt them.

Their noſtrils are oblique, of an oblong figure; their hoofs large in proportion to the other parts of their bodies; the cleft hollowed internally, that the parts may touch accurately at the dividing line at the bottom: the true and falſe hoof are the ſame as in the reſt of the genus.

The tail hardly grows to the length of a quarter of an ell.

The

The female has four true paps, two falſe ones.

The wild Rhendeer grows to a much larger ſize than thoſe which are tame; in the ſame manner the common bull is obſerved to be much milder and ſmaller than the ſame animal wild.

FOOD.

§ 6. In Summer, when the Rhendeer ranges upon the Alps, it feeds upon various vegetables: from the Experiments of Hagſtrom, it appears that it refuſes to eat forty-ſix ſpecies of plants whoſe names he has given.

In Winter it ſubſiſts upon various kinds of Lichen, but its principal food is the Rhendeer Lichen; of which we obſerve two varieties, the firſt is called the Sylveſtris, which is extremely common in the barren deſarts of Lapland, and more par-

particularly in its ſandy and gravelly fields, which it whitens over like ſnow; its vaſt marſhes full of tuſſucks of turf, and its dry rocks are quite grown over by it. The ſecond variety of this plant, which is leſs frequent than the former, is named the Alpine, this grows to a greater height with its branches matted together: it has this name, becauſe when thoſe mountains are cleared of their wood, the whole ſurface of the earth is covered with it; yet it is ſeldom to be found on their tops. When the woods become too luxuriant, the Laplander ſets fire to them, as experience has taught him that when the vegetables are thus deſtroyed, this Lichen takes deep root in the dry and barren ſoil, and multiplies with facility; though it requires an interval of eight or ten years before it comes to a proper height. The Laplander eſteems himſelf opulent, who has extenſive deſarts producing this plant exuberantly: when it whitens over his fields, he is under

der no neceſſity of gathering in a crop of hay againſt the approach of winter, as the Rhendeer eats no dried vegetable, unleſs perhaps the Equiſetum fluviatile*. They root for this Lichen under the ſnow like ſwine in a paſture; their foreheads, noſes, and feet are guarded with a hard ſkin, cloſely attached to thoſe parts, that they may not be hurt by the icy cruſt which covers the ſurface of the ſnow. The very ſtrong ſhoes which the Laplander eſteems ſo much are made of theſe parts of the hide. It ſometimes happens (but very rarely) that the Winter ſets in with great rains, which the froſt immediately congeals, the ſurface of the earth is covered with a coat of ice before the ſnow falls, and the Lichen is entirely incruſted and buried in it: thus the Rhendeer is ſometimes ſtarved, and a famine attacks the Laplanders. In ſuch an exigence they have no

* River horſetail.

no other reſource but felling old fir trees grown over with the hairy Liverworts; this is very inadequate to the ſupply of a ſmall flock, and the greater part of a large one infallibly periſhes with hunger.

Thus the Laplander is continually occupied with the care of his flock by night and day, not only in Summer, but alſo in every ſeaſon of the year; and is obliged to wander up and down in his immenſe woods during all the extremities of a polar Winter. The miſerable herdſman muſt ſink under ſuch revolutions of diſtreſs, did not nature balance them with comforts able to ſupport him under them. During his long night, the froſty brilliancy of the ſtars, the reflection of the ſnow, and the Aurora Borealis with a thouſand diverſities of figure and radiation, ſupply the abſence of the ſun: his cloaths, gloves and ſhoes, are furniſhed him by the hide of the Rhendeer, and the two latter being ſtuffed with the Carex veſicaria, are

a ſufficient protection againſt the utmoſt extremity of the cold. With his dog and his pipe of tobacco, his only luxury, he lives as contented and happy as the Tityrus of Virgil in the voluptuous ſhades and fine climate of Naples, even under an intenſity and rigour of cold, the deſcription of which makes us ſhudder with horror; with ſuch ductility does nature yield to early habit.

On the LAPLANDERS.

§ 7. The Laplanders are divided into Mountaineers and Woodmen: thoſe who are called Mendicants are rather to be reckoned as belonging to the latter; they wander up and down in our woods beyond the proper limits of Lapland, and are a mixture of various people, differing from the genuine Laplanders very much in their manners and cuſtoms. The Mountaineers poſſeſs certain portions of land in the Alps where they inhabit in Summer,

Summer, and the huts of two or three families are built together. There is a tranquillity and cheerfulneſs in their characters, they poſſeſs conſiderable herds; and about Autumn they remove into the deſert, to ſpend their Winter among the inhabitants of the woods; for in the months of November, January and February, there are not above three or four animals which are able to ſupport life in the mountains; even the ſnow ſparrow is obliged to ſeek a milder climate.—— The wood-laplanders live each upon their own lands in the deſert, and build their huts at a diſtance from each other; two are ſeldom to be found together. Their herds are much ſmaller than thoſe of the Mountaineers, and in Summer they ſubſiſt by fiſhing in their great rivers. They are in general very poor, their ſolitary life impreſſes miſery and melancholy upon their characters: they hardly ever travel into the Alps, unleſs they have large herds, which is very ſeldom the

caſe. The Mountaineer very often poſſeſſes three or four hundred, or even a thouſand head of Rhendeer; the Woodman very rarely above one hundred.

GNATS.

§ 8. *The Gnat is a moſt troubleſome perſecutor of the Rhendeer; but as this ſeemingly contemptible inſect acts a part of ſuch conſequence in this country, I ſhall go into the whole of its hiſtory with ſome detail.*

When the ſnow begins to diſſolve in the deſert, as alſo in the Alps (which latter happens about the time of the Summer Solſtice) the heats in the deſert are very great: at that time begins the greateſt calamity which the Laplanders experience in their climate, the plague of an intolerable ſwarm of Gnats (Culex pipiens): the immenſe collections of ſnow formed upon the Alps in the Winter begin to melt even upon their icy ſummits, their

their largeſt rivers overflow, and covering the land, the water ſtagnates whereever a concavity is leſt; by which cauſe this country abounds more in lakes, marſhes and fountains, than any other. In theſe marſhes the Gnats depoſit their eggs, and hence they ſwarm in Lapland to a degree perhaps not ſurpaſſed in any other part of the globe. In Summer time, when theſe inſects are in a flying ſtate, they fill the air like clouds of duſt: the Laplander of the deſert, whenever he moves out of his houſe, is obliged to ſmear his body over with a mixture of pitch and milk to protect him from the bite of theſe inſects: they even get up into the noſtrils, and in the air, if he opens his mouth to ſpeak, they inſtantly enter; nor does his hut protect him, unleſs it be conſtantly filled with wood ſmoke, which drives them away. Yet notwithſtanding theſe incommodities, Nature has made them in one reſpect ſubſervient to his advantage in a very conſiderable degree:

the Aquatic birds deſert the lakes of Lapland about Autumn every year, before they begin to be frozen up, and fly away South. At the firſt return of Spring we ſee them covering our whole ſky, ſtretching back toward the North: the greateſt part of them ſtop in Lapland, where they find abundance of nouriſhment in feeding upon the Gnats, then in their vermicular ſtate. Theſe birds, on account of the down interſperſed among their feathers, are unable to bear the heat of a Southern Summer, but are obliged to fly to the colder Northern climates. As they do not pair for the breeding ſeaſon, the female is neither ſupported by the male with food in the time of incubation, or during the period in which ſhe is obliged to feed her young: therefore having covered her eggs with the feathers which ſhe ſhoots at this time, ſhe is obliged to leave them in queſt of food, which ſhe neceſſarily muſt be able to find in ſufficient quantity near: when their numerous

rous brood are freſh hatched this neceſſity increaſes, and the waters ſupply them abundantly with theſe Gnats in their vermicular ſtate. Thouſands and even myriads of Moor game, taken in theſe deſerts, are ſent to Stockholm yearly.—The young birds are fed till Autumn upon theſe Gnats, afterwards they betake themſelves to the berries of the Privet, the Juniper and other plants: they are ſnared in ſuch plenty by the Laplander in Autumn, as to form his whole ſubſiſtence, as the eggs of the water birds are almoſt his whole ſupport in the Spring: not to mention the abundance of fiſh in their lakes and rivers is greatly multiplied by the copious food theſe inſects afford them.

But to return to our ſubject; beſide the intolerable perſecution the Laplander himſelf receives from them, they alſo greatly infeſt the Rhendeer: the hairy rudiments of their horns, which ſhoot up every Spring,

Spring, are continually ſubject to their pungent bite, no leſs than to that of the Tabanus tarandi; nor does the Gad fly allow this animal a moment's quiet. The Rhendeer return every day to the Laplanders hut, to be there fumigated with Agaric to obtain a little interval of eaſe from their perſecutors. After this fumigation, and milking, they directly make off for the ſummits of the Alps, to protect themſelves from theſe inſects, which cannot live in perpetual cold, and the ſtorms of thoſe ſavage mountains. There are ſome Gnats in the Alps as well as in the Deſert, and even of the ſame genus; but then they are larger, and pierce the ſkin any where indifferently, not ſeeking out the pores. They are leſs numerous, and found chiefly in the vallies of the mountains which are grown over with ſhrubs, and where the air is ſomething more calm; therefore the Rhendeer eaſily avoids them by eſcaping to a higher part.

GAD-

GAD-FLY.

§ 9. But the greateſt enemy to the Rhendeer is the Gad-fly, which our Preſident has deſcribed in various places. —This inſect, of which he entertains the ſtrongeſt inſtinctive fear, is called the Curbma by the Laplanders.----It is generated from an egg depoſited in his back, and eats its way out in the middle of ſummer, when the Rhendeer ſhoots his hair. And as at this ſeaſon there are no herds of Rhendeer to be found in the deſert, except thoſe of very poor owners (which upon account of the ſmallneſs of their number it is not worth the while to drive into the mountains) it conſequently follows that the Gad fly is more numerous in the Alps than in the deſert, as the number of Rhendeer fed there is greater. As ſoon as the Gad fly comes out it hovers over the Rhendeer, totally intent to drop its egg among his

erect hair; the herd on the other hand are filled with ſuch a provident fear, that if there be a thouſand together, they toſs their horns, and every one trembles all over at a weak unarmed fly. But becauſe the young Rhendeer do not change their hair the firſt year, and it lays flat and does not ſtand erect, no egg can be lodged among it. Therefore the ſecond ſpring they are free from thoſe ulcers which are generated by the latent Gad fly on the ſide of the back bone: but when the egg is lodged in the hair, and there hatched, it perforates the ſkin, and greatly emaciates and conſumes the Deer. They are moſt liable to this diſorder the third year, and this is the cauſe why the hide of the Rhendeer has ſo many ſcars near the middle of the back.

In Summer, when milking time is over and the herd leaves the hut, there is always a great contention between the Deer and the dogs which guard them; the

Rhendeer

Rhendeer conſtantly endeavours to go againſt the wind, and get up among the loftieſt rocks covered with perpetual ſnow, and there remain the whole day faſting, rather than be expoſed to the Gad fly; the Laplander endeavours to confine them in the vallies to prevent their ſtraying, and pays little regard to the fly, not knowing the evil it brings upon the herd. He builds no ſtable for them, collects no winter food, but takes it by turns with his fellow herdſman to watch and wander with them day and night throughout the whole year:—Every herdſman has his dog, which is excellently well trained to obedience, and to hinder the Rhendeer from ſtraying. The Crows follow them to pick the Gad flies out of their backs, and eat them, a torture which (as I have been aſſured by Monſ. Fjellſtrom, a native of Lapland) after they are tired out by endeavouring to eſcape, they are ſometimes obliged to ſubmit to.

MILK.

§ 10. The female brings forth about the middle of May, and gives milk from the 24th of June to the middle of October: the herd is brought up to be milked morning and evening; a rope, both ends of which are held in the hand, is flung over the neck of the Doe, and thus ſhe is compelled to ſubmit; they give about a pint of milk each. Their paps are afterwards ſmeared with a ſubſtance diſagreeable to the fawn to prevent its ſucking, which is waſhed off at the next milking. The Does are extremely fond of their young, and if by chance they loſe one, they ſeek is every where, and even return to the hut mourning with a voice like a pig, and never reſt until it be found. The milk of the female Rhendeer ſeems of a thinner conſiſtence than that of the Cow, its flavour ſtronger, and of a taſte nearly reſembling tallow: when new, and warmed

warmed over the fire, it is turned to curd by rennet, which is taken indifferently from ſuch fawns as are killed, or dye of themſelves, or the entrails of the fiſh called the Caregonus Thymallus*. The cheeſe is preſſed in ſmall baſkets, and kept near the ſtove;---it never is deſtroyed by maggots; the reaſon of which ſeems to be that the Muſca fimetaria is not to be found in Lapland: at leaſt Linnæus was not able to diſcover it there. This cheeſe, which is very nutritious and good, is the principal part of the travelling proviſion of the Laplander, and the oil which drops from it when toaſted ſupplies them with an immediate remedy againſt kibes. The Whey which remains after making the cheeſe, being boiled, has the conſiſtence of cuſtard, and furniſhes the Laplander during Summer with his dinner and ſupper: however, though it recommends itſelf to the palate, it is a very unſubſtantial and meagre diet. No butter

* Faun. Suec. p. 134.

ter is made from this milk; for the quantity which is obtained from it is very ſmall, of a white colour, and has the taſte of tallow.——The Laplanders do not know the uſe of milk in the preparation of a number of delicacies for the table, which are in faſhion with us; they make of it the Kappatialmas (as it is named in their language) which is the ſkim of boiled milk, after it has cooled, mixed with the berries of the Myrtillus, and preſerved dry in the form of cheeſe: their Juemo-melke (Northern-milk) is prepared in the following manner; they gather freſh leaves of ſorrel (which in the Alps grows to four times the ſize that it arrives at with us) and boil them firſt in water, then pouring on whey repeat the boiling, and preſerve this mixture in caſks for Winter and Spring.

PROPA-

PROPAGATION.

§ 11. The time of the female receiving the male is from the Feaſt of St. Matthew to Michaelmas, but they rarely copulate before the third year; the Doe goes with young thirty-three weeks, whence the time of yeaning is about Eric's day in May, and they generally have two fawns at a birth.

A great part of the Males are caſtrated when very young; the moſt robuſt of theſe are ſelected for burthen and draft; if they be reſted, they grow fatter than the Bucks, but otherwiſe are inferior to them in condition.

AGE.

§ 12. The Rhendeer ſeldom ſurvives the 14th or 16th year; when a male of that age grows fat toward the end of Autumn,

tumn, or a female becomes barren, it is killed off, as it would otherwiſe die naturally. But the ſhort life of the Rhendeer totally refutes that dream of antiquity, that ſtags are the moſt long lived of all animals, and that they even attain the age of a thouſand years: the period of life in viviparous animals is in proportion to the time of geſtation, and in thoſe which are oviparous to that of incubation; the Stag and the Rhendeer are animals of the ſame genus, from which we may infer that the life of the former cannot exceed thirty years.

USES.

§ 13. The Rhendeer is killed before rutting time, as it then grows lean: the fleſh is dried in the air, or ſmoked, then packed in their waggons until the time of leaving the Alps arrives, when it is put in little ſtore-houſes, called by the inhabitants

tants *Staburer*; theſe are made in the form of ſmall huts, and placed upon trunks of trees, about four yards from the ground, to protect them from thieves, or being plundered by bears. They diſcontinue killing about the feaſt of St. Matthew, as the herd being then tormented with the Gad fly becomes lean; they may be killed throughout the whole Winter. A ſingle Rhendeer ſubſiſts four perſons a week; but in the Spring they live as much as poſſible upon fiſh to ſpare them: and for the ſame cauſe, during Summer, the Laplander contents himſelf with the whey preſſed from the cheeſe he makes, and in Autumn his food is Moor game, either ſnared or ſhot.——The Rhendeer is killed by piercing the ſpinal marrow near one of the firſt vertebræ, by which it immediately falls; afterwards it is ſtabbed to the heart on one ſide of the breaſt, and the blood collected in the cavity of the Thorax: the body is then flayed, and (as we have before obſerved)

the excellent hairy ſhoes of the Lapland-ers are formed of the feet and forehead of the hide, as on thoſe parts it is furniſhed with the moſt tenacious and ſtrongeſt hair. Almoſt every part of the Rhen-deer is eaten by them except the brains.

The horns are piled in heaps near their huts, the Fox and Squirrel prey upon their extremities; they have lately gotten into a method of preparing a very tena-cious glue from them: they likewiſe are uſed inſtead of harts-horn to make jelly, but they are more difficult to raſp, and require longer boiling.

The Fawns which die in the Summer are flayed, and their ſkins being ſoft, are uſed for the inner garment of the Lap-lander inſtead of linnen, of which he is entirely deſtitute: all their other clothes are of Rhendeer ſkin, with the hair out-ward; their warmth principally conſiſts in its thickneſs: the hide flung over the

leaves

leaves of the Betula nana* ſerves him for a bed, which is placed by the ſide of the fire.

Very beautiful and warm cloaks are made likewiſe of this ſkin, which are worn in the Southern provinces of Sweden, in Winter, by people of rank.

The blood is preſerved in veſſels made for that purpoſe, and in Spring they make a broth of it with marrow, and the addition of a quantity of water; they carry it with them in bladders on a journey, and it reſembles the blood of ſwine in its flavour.

The tongue, which is extremely fat, and a great delicacy, is dried and ſent for ſale to the Southern provinces of Sweden. The fleſh is boiled in water without any addition, like fiſh, with this difference, that the Laplander boils his fiſh very much, but his veniſon very little. The fat is ſkimmed in wooden

* Dwarf-birch.

veſſels, which are handed round at a great feaſt, and every perſon takes a ſpoonful or two. The marrow is delicate, and a provocative: the bladder ſerves as a bottle to contain the diſtilled ſpirit of wheat: the Laplander almoſt conſtantly confines his meal to a ſingle diſh. The tendons of the Rhendeer are divided into threads and ſpun, they are preferable to hemp for ſewing their fur coats; the women cover them with tin foil, and ornament their clothes with ſome elegance with them: they make cups of the bones, which ſerve them inſtead of drinking glaſſes.

The Man's conſtant employment is to milk the herd, and make cheeſe, the Women make clothes.

§ 14. The fat of this animal is not compoſed as in others of ſmall coherent maſſes, but much mixed with fleſhy fibres.

The

The feet of the Rhendeer when in motion always make a rattling noiſe like nuts ſhaken together, becauſe when he ſteps, the ungulæ are widely ſeparated by the preſſure of his weight, and when he lifts his foot up again, they clatter as they meet.

It is abſolutely certain that the Rhendeer chews the cud as well as all other animals of the 4th order called Pecora, he is obſerved to do it every day when he lies down in the ſmoke of the hut; Ray therefore was right in conjecturing it from analogy to be a ruminating animal, as well as the reſt of the ſpecies of the ſame genus; and Scheffer, with his epitomizer Hulden, inexcuſable in aſſerting the contrary, when profeſſedly writing upon the ſubject.

DISTEMPERS.

§ 15. The various diſorders to which this animal is ſubject, are the following:

1. The Gad fly, or Curbma, which we had before treated of, debilitates them very much; and many are deſtroyed by it in their third year, though they are free from it in their ſecond.

2. Maggots are generated in the palate and ſinus of their foreheads, in the ſame manner as in horſes and ſheep; when the Rhendeer is hard driven in Winter, it ejects them by ſneezing. Theſe are called Trumbe by the Laplanders, and proceed from an egg depoſited in the throat of the animal, which being hatched into a maggot, is expelled through the noſtrils; in the Spring this is more fatal to the life of the animal than the Gad fly.

3. The

3. The Vertigo (Rings-juka) ſometimes attacks the Rhendeer; thoſe afflicted by this diſorder perpetually turn in a circle; if they turn to the right the Laplander thinks the diſorder curable, if to the left incurable, and they are immediately killed.

4. The Anorexia, or a diſguſt at food, is very frequent in the young deer; they totally abſtain from food in this diſtemper, and ſtand ſtill chewing the cud.

5. Cracked paps they are ſometimes troubled with, which bleed in milking; the Laplanders are ignorant of the remedy applied in other Alpine countries againſt this diſtemper, both by ſhepherds and cowherds, which conſiſts in rubbing the teats of the diſeaſed animal with the juice of the Pinguicula*, which grows with them in great plenty.

* Butterwort.

6. St.

6. St. Anthony's fire (Herpes) an eruption of very minute puſtules, is another of this animal's diſorders; it commences upon the udder, and ſpreads very wide: it is not mortal to the doe, nor directly ſo to the fawn which ſucks of her; but its mouth becoming ulcerated, it is no longer able to feed, and dies ſtarved.

7. The Klòf-Sjuka, is a ſwelling of the feet round the margin of the ungula, tending to become putrid, the animal is particularly liable to this diſorder upon the ſucceſſion of a few hot days: from ſome obſervations of Linnæus in his Tour in Weſt Gothland, it ſhould ſeem that this diſtemper is occaſioned by the Gad fly.

8. The Fallsjuka is an ulcer in the muſcular part of the thigh, beginning by a ſmall tumour, which being opened, diſcharges a copious pus, which afterwards

wards becoming black and in a manner ſphacelated, ſmall parts are ſeparated and ſlough off; if the part thus coming away be regenerated the animal recovers; if not it dies: if the Deer lick it he is often attacked with internal ulcers, which prove mortal; this diſtemper is epidemic.

9. The Tran-sjuka is a very peſtilential and fatal diſorder to which the Rhendeer is equally ſubject in Summer and Winter; and ſeems at preſent rather increaſing and extending itſelf, than to ſhew any ſymptoms of being upon the decline. Twelve or fourteen years ago it was abſolutely unknown in ſome diſtricts where it now rages with great violence; and for five ſucceeding years it made ſuch havoc in the province of Lapland called Tornea, that almoſt all the Rhendeer of the Wood-land were deſtroyed by it. The firſt ſymptom of the animal being attacked by it is a dif-

ficulty of reſpiration; the noſtrils become wider and more extended, the eyes are enlarged and fixed, ſo as to remain a few moments without ſhutting; he becomes extremely ferocious, driving at and knocking down every one with his horns: he eats as much as when in perfect health, but does not chew the cud; and lies down oftener than the reſt of the herd. No remedy has yet been diſcovered for this diſorder, which is certain death. The Laplander immediately kills the animal as ſoon as he exhibits the leaſt ſign of being attacked by it; he then flays it if the hide be worth preſerving, but that of thoſe who die by the diſtemper is reduced to the thinneſs of paper: Upon opening the animal, a frothy matter is found in the brain and about the lungs: all the viſcera are ſoft and flaccid, but particularly the ſpleen, which appears extremely lacerated, diminiſhed and exhauſted.

The Laplander applies one common remedy to all theſe diſorders, ſmearing the back of the Rhendeer with tar, which though not of uſe in every caſe, yet hinders the Gad fly from depoſiting its eggs there, which when hatched would perforate the ſkin.

NAMES.

§ 16. The Laplander gives his Rhendeer proper names, there are alſo ſome deſigning their ſeveral ages.

The caſtrated Rhendeer live longer than the males kept for multiplication, whoſe ages ſeldom exceed ſeven years: the facility with which the herdſman diſtinguiſhes a ſingle animal in a flock of more than a hundred, and calls him by his proper name, is very admirable; although they change their colour and hair with the various ſeaſons of the year, and particularly their horns, which annually aſſume a new

form. There is no probability in the following circumſtance which Ariſtotle relates of the Stag, that if it be caſtrated when it has loſt its horns, it never recovers them, but if otherwiſe never ſheds them again afterwards; the caſtrated Rhendeer loſes his horns, and produces new ones again annually at the ſame ſeaſon as the reſt of the flock.

In Winter the Rhendeer draws the ſled by a rope which paſſes between his legs, and is guided by a rein fixed to his horns; he cannot bear more than the weight of a man: when hard driven he will run ten or twelve Swediſh miles, but he muſt be immediately killed, as he ſeldom ſurvives the fatigue: he frequently is able to run ſix or ſeven miles at a ſtretch without reſt: this animal is very weak in the back and unable to bear a ſaddle, therefore when the Laplanders make their journeys in the Summer, they make

make uſe of a ſmall pad, which they load with a very ſlight weight.

WILD STATE.

§ 17. The wild Rhendeer grow to twice the ſize of thoſe which are tame, and have a much firmer hide; they have been ſo far extirpated in the inhabited parts of the Alps that they are ſeldom ſeen except in the diviſion of Kemen, but in the Alps of Dalekarlia, which are very thinly inhabited, they frequently appear in herds of a hundred or more.

CONCLUSION.

§ 18. Thus the Laplander ſurrounded by his herd of Rhendeer poſſeſſes every neceſſary of life; the owner of five hundred or a thouſand head of deer is a man of property in compariſon of his neighbours; they yield him every year half the num-

ber

ber for conſumption, a rate of profit on a capital of which we have no example in Sweden. In a country of froſt and barrenneſs he leads a life of the moſt profound tranquillity, he entertains no fear of the ravages and cruelties of war which deſolate more opulent countries, and is exempted from that perpetual yoke of ſervitude which weighs down the neck of our peaſantry: he lives free from a thouſand diſtempers common in other nations; that long train of elegant poiſons, which, while they pamper appetite, prey upon the vitals, are not among his neceſſaries of life; and he exhibits an indiſputable proof that he who wants few, not he who poſſeſſes many things, is the rich man.

DISSERTATION V.

ON THE

MIGRATION OF BIRDS,

BY

CHA. DAN. EKMARCK,

Of Oſtrogothland.

Am. Acad. Eſſay 75. v. 4. p. 565.

SUMMARY.

Preface —— Migration, what —— fiſhes migrating —— Regular orders of flight —— cauſe of migration —— Duck tribe reſort to Lapland —— ſubject not well known —— mode of perfecting it —— Writers

Writers on it——ancients——Bellonius' obſervations in the Eaſt——Cateſby's in Carolina——Kleinius' at Dantzic——Haſſelquiſt's in Egypt——Migrations of foreign birds——on the Tables——Birds natives here——cauſes of migration——Heat and cold——Water birds remove in Winter——alſo inſectivorous——food plenty and ſcarcity——(inſtances)——ſtructure of their bodies——cuſtom——Birds not migrating——final cauſe of migration——Diſſemination of plants——fiſh——deſtroying vermine——courſe.

PREFACE.

§ 1. *THE hiſtory of birds is that branch of natural knowledge to which my reſearches have been chiefly directed: their anatomy, external beauty, modes of life and migration furniſhing a con-*

continual variety of pleaſure and information: it is the laſt of theſe articles which I have taken for the ſubject of this eſſay.

MIGRATION.

§ 2. By this Migration we underſtand a conſtant cuſtom in many different kinds of birds of quitting their uſual places of reſidence every year at ſtated times, and removing to others more or leſs remote: ſomething like this may be obſerved to take place in fiſh in the ocean; by a natural inſtinct they every year move into warmer waters near the ſhores, that their ſpawn being depoſited there may be hatched by the heat; and thus a number of them are taken by men, or become a prey to Kites and various ſpecies of water-fowl.

We every year obſerve whole armies of birds drawn up in the moſt exact order, returning to viſit us in the Spring,

leaving their Winter quarters, where they had been driven to avoid the rigour of our northern climate; ſome moving in a line perpendicular to the direction of their flight, others in one coinciding with it: ſome form an angle, the middle bird dividing the air before the reſt; and others fill up the vacuity between its lines and conſtitute a complete military wedge: it would be an endleſs taſk to enumerate all the figures in which the different ſpecies fly.

In Autumn, when our herbs begin to wither and inſects to ceaſe to appear, our birds not being able to diſcover their food, leave us and fly off to the warmer provinces.

Our illuſtrious Preſident, in his M.S. account of his Tour in Lapland, relates that in the year 1732 he ſaw the whole river Calix, (which is not the largeſt of that country which diſcharges itſelf into the ſea) covered for eight continued days

and

and nights with a quantity of the Anates*, ſurpaſſing in number the army of Xerxes: and that he could ſcarce conceive that ſuch a multitude exiſted; theſe all moved toward the ſea, and then continued their courſe South. If we make allowance for the other rivers in Lapland which, without doubt equally abound with them, what a number muſt we conceive to migrate from that country only?

The places where the birds of paſſage migrate to, and the tract which they purſue are at preſent but little known, and the diſcovery of them would require much induſtry: the labours of poſterity and the concurrence of accurate obſervations from various countries can alone reſolve ſo intricate a difficulty. If an experienced Naturaliſt, reſident in the South of Spain or Italy, were to take an account of their arrival and departure Northward and Southward, noting

* Gooſe tribe.

the ſpecies of birds, and the day of the month, this ſubject would preſently receive great illuſtration: parallel obſervations at Conſtantinople would be of the higheſt advantage to it.

AUTHORS.

§ 3. The ancients were either ignorant of the migration of birds, or did not judge it worthy a particular attention: therefore we find only a few ſlight veſtiges of obſervations of this kind in their works. Modern writers have paid rather more attention to it; among theſe there are four who have conſidered it with the care it ſo well deſerves: Peter Bellonius, in his travels into the Eaſt, publiſhed two hundred years ſince, has many pages upon this ſubject; he relates that he ſaw many flights of birds moving either North or South, and gives his opinion that they flew beyond the limits of Enrope.——

Cateſby

Cateſby obſerved the migrations of birds both to the North and South in North America, which he has treated of in his firſt volume of the Hiſtory of Carolina: ——J. T. Kleinius, in the Preface to his Hiſtory of Birds, has treated this ſubject in a maſterly manner, and with great ſolidity; and having accurately ſtudied Cateſby, has extended it with his own excellent diſcoveries in this branch of Ornithology:—Haſſelquiſt, in his travels, has likewiſe furniſhed us with many particulars of the birds that winter in Egypt. I am compelled to acknowledge that my courſe of engagements in life have prevented me from collecting as much original matter upon theſe migrations as I could wiſh to have acquired; yet I have not heſitated to lay this Eſſay before the public, in hopes to excite the diligence of my countrymen to purſue this ſubject, as in theſe northern regions more diſcoveries relating to birds of paſſage are to be expected than in any other.

FOREIGN

FOREIGN BIRDS.

§ 4. Cateſby obſerved the migrations of birds in North America with great attention; *The ſubſtance of his diſcoveries are digeſted in the form of a table annexed to the end of this Eſſay, but his account of the Fringilla oryzivora deſerves to be preſerved entire**."

In the beginning of September, when the rice in Virginia and Carolina is in a ſoft

* The paſſages in Italics are added to the original. The obſervations extracted from Cateſby are of ſuch a kind as to be better digeſted in the form of a table than inſerted in the text; they are twenty-four in number; the ſimilarity which neceſſarily runs through them, and the greater eaſe with which any matter is to be found in a table than confounded among many other things, determined me to caſt our author's collections and obſervations upon the ſubject into that form.

Where the account of them igration of any bird was not ſo meagre as to be confined to its different ſtations with the day of its arrival and departure from each, I have given it at length in the text, abridging it in the tables, that they might be compleat.

ſoft ſtate, after the harveſt for it is over in Cuba, numerous flocks of females (a great ſingularity) arrive in the two former provinces; where they ſtay about three weeks, until the rice grows hard, and are gone about the end of the month. It has not been diſcovered where they betake themſelves to afterwards; but meeting their males and mating, they paſs through Carolina again in the beginning of the Spring.

Kleinius purſued this enquiry with great diligence at Dantzic; his obſervations are contained in the ſecond table. The third table conſiſts of extracts from Haſelquiſt's Travels to the Eaſt, which have furniſhed much excellent matter; *but the following articles claim a place here.*

The Tringa*, Charadius‡, and many ſpecies of the Scolopax come into Natolia in the months of December and January:

* Sand-piper. ‡ Plover.

nuary: but the birds of the ſame ſpecies which are natives of Greece and Turkey, go into their winter quarters in Egypt in the beginning of October; in the ſame manner as the European birds into Natolia.

The Charadrius pluvialis* arrives in Egypt in November, where it ſtays all the Winter and a conſiderable part of the Spring.——Muſt we believe that the pluvialis (which is among the laſt birds that reviſit us in Spring) can take ſo long a flight?——The ſame is obſerved of the Tringa vanellus†, and the ſame doubts may ariſe upon the ſubject.

The Anas boſchas‡ and Penelope§ arrive in great number in Egypt after the inundation of the Nile; but it is incredible that thoſe which migrate from Sweden can reach ſo far.

The

* Green plover.
† Lapwing,
‡ Mallard.
§ Widgeon.

The Monedula pyrrho corax comes in immenſe flights into Egypt in the beginning of November, it ſubſiſts together with the Storks and migrating Falcons upon frogs and other amphibious animals which cover the whole ſurface of the land; this bird is found in Summer in England and France, but never in Sweden.

NATIVE BIRDS.

§ 5. In treating of our native migrating birds I ſhall enumerate all thoſe that dwell with us during the Summer, and leave us in Autumn, or at the approach of Winter; that upon their arrival in more ſouthern countries, foreigners may be able to conjecture with ſome certainty where they come from, as I am under a neceſſity of owing that I am unacquainted with the countries to which a great number of them reſort after they leave us:— I likewiſe thought it might be of ſome

uſe to add a Catalogue of the names of thoſe birds which I had found with certainty, ſtaid with us the whole year, being able to bear the Winter.

Theſe are ſeparately digeſted in the fourth and fifth tables; and thoſe whoſe hiſtory ſeems to require more detail than is conſiſtent with the brevity of that form are the following.

Many birds of the firſt order (the Accipitres*) remain with us all the year; for being birds of prey they can ſupply themſelves with food in the Winter: thoſe which ſubſiſt upon amphibious animals and inſects (which remain concealed during that period) migrate.

Of the ſecond order the Picæ, ſome remain with us, others go off.

* Hawks.

The

The Corvux cornix*, according to the obſervation of Arch. Rudbeck, continues through the Winter in Tornea and Upland; in Oſtrogothland the greater part of them ſtay, but in Smoland, and the other ſouthern provinces, they fly away at the beginning of Winter, and return with the firſt breaking up of the froſt about March 19: the time they are abſent they reſide upon the ſea ſhore, feeding upon what it caſts up.

The third order, the Anſeres, are moſt of them birds of migration; when the waters are frozen up, and they are no longer able to procure themſelves food as formerly: they all of them make for warmer climates, except a few who fly down to the ſea coaſts, where they are not prevented getting their uſual ſubſiſtence by the ice.

* Royſton crow.

The Anas anſer* goes off in flights about the 22d of September, and does not winter in Sweden; I am rather induced to think it makes for the bays near Holland, or further ſouth: In the very beginning of Spring, when the thaw is pretty far advanced, they paſs over us again, forming an obtuſe angle in their flight, and make for Lapland, or further north, before they take up their Summer quarters.

The Anas bernicla† frequently winters in the low countries, where they are taken in ſuch plenty that all the poulterers ſhops in Amſterdam are full of them; they all paſs us in their way to the North, a few ſpend the Summer in Lapland, but the greater part proceed to a further diſtance.

The Anas hiemalis is ſeldom ſeen here but in the ſevereſt Winters, when it is

* Gooſe. † Brent gooſe.

is found near unfrozen ſprings; this is an indication that it is a native of the frozen ſea between Lapland and the Pole, and that a particular ſeverity of cold compels it to ſhelter with us.

The Anas acuta arrives upon our coaſts in Spring, but does not ſtay with us above fourteen days; it never builds its neſt here, but haſtens further north, and I am inclined to think flies as far as the white ſea; it paſſes us again in the beginning of Autumn in its courſe toward the ſouth.

The Anas Clangula* ſometimes continues with us the whole Winter, when the rivers and water falls are not frozen up; yet the greater part of them migrate, but return the firſt of all birds in the Spring, and as ſoon as the ice begins to break (March 19) they cover the cracks in thick

* Golden eye.

thick flocks: they live upon ſhell fiſh, and other things of the ſame kind, which they dive extremely deep for, and can ſubſiſt at all times of the year when the water is free from ice.

The Pelecanus carbo* does not deſert the Bothnic gulph until it be frozen up; then he paſſes through Sweden in his paſſage to the great Ocean, and is found reſting upon trees and the tops of houſes.

The Alca torda† arrives at the ſteep clifts of the Swediſh iſles on the 12th of May; it lays but a ſingle egg in its neſt, and is one of the firſt birds which deſert us, flying away in the beginning of September.

The Colymbus auritus‡ is a bird very ſeldom ſeen in our waters, being found further North, and particularly in the lakes of Lapland, where he builds a floating-

* Corvorant. † Awk.
‡ Leſs-creſted diver.

floating neſt upon the water of ruſhes and reeds. Montin relates a ſtrange ſingularity of this bird, that it is unable to fly, and that it paſſes the Winter under water like the Swallow: Dr. Solander, when in Lapland, diſcovered this account of its inability to fly to be a fiction. It is therefore moſt probable that this bird, as well as the reſt of the genus, migrates, as it is never ſeen in Winter; and that it takes its flight directly toward the ſea, as we never obſerve it paſſing over the continent.

The Procellaria pelagica* never viſits the Baltic, unleſs driven there by ſome accident; it is an inhabitant of the great ocean, always remaining there, and ſeems to deſpiſe the utmoſt violence of its ſtorms which endanger the ſtouteſt ſhips.

The fourth order are the Grallæ; all the birds of this order migrate as if by common

* Storm-finch.

common conſent, nor is there one which remains with us the whole year; for as in Summer they cannot ſubſiſt in the South upon account of the drought, and the want of worms, they cannot live through the Winter in the North, the ground being frozen.

The Ardea grus* reviſit us in the Spring in whole flocks, and their time of breeding being ended, ſcatter themſelves over the face of the country; they generally return to the ſame neſt every year.

The Rallus crex† arrives here about the beginning of June, and is found in ſedges and corn fields, where it is diſcovered by its acute note, which it repeats twice; it is heard principally in the night, when the Earth worm, upon which it principally feeds, comes out of the ground:— it ceaſes to be heard at the time the Cuckow leaves off his note; yet it ſtays with

* Crane. † Land rail.

with us until Autumn, which is clearly proved by its young being found in reaping pea fields.

The Tetrao urogallus† and Tetrix‡ live in our pine foreſts in Autumn upon the Vaccinium, and in Winter upon Juniper berries and the ſeed veſſels of the Birch: their young ſubſiſt upon Gnats, which abound in the woods, particularly thoſe of Norland, which is the principal breeding place of the Tetraones: they ſtay in our cold provinces, and when a heavy ſnow falls, remain quietly upon the ground until they be totally buried in it; underneath this covering they form themſelves walks, in which they can live for the ſpace of forty ſucceſſive days.

The Tetrao perdix§ lives in Autumn upon Rye leaves, he remains with us all Winter, and makes burrows under the

† Cock of the Wood. ‡ Black game.
§ Partridge.

ſnow, which are left open at both ends for reſpiration; in theſe burrows the whole brood harbour together.

The Columba palumbus* is able to ſupport the rigour of this climate, there being one which has ſurvived many Winters in the open air in the Phyſic Garden of Upſal: in Autumn they leave our woods, without doubt for want of food; whither they go in Winter I confeſs I am unable to determine; but it is certain it cannot be to any great diſtance, as they are among the firſt birds which return to us in Spring: when deep ſnows fall after their return, or they are ſurpriſed with Winter before they take their flight, which ſometimes happens, they are cut off from their food, and though extremely timid, are obliged to venture into the villages to procure it.

* Ring dove.

The

The Columba oenas* diſappears about the middle of October, and returns about the 12th of April with the Motacilla alba§; the vulgar have many fables about the wintering place of the former: a peaſant once aſſured me, that in felling an oak, he found a bird of this ſpecies, which being ſtiff he carried home; and that it recovered ſtrength and motion by the warmth of the houſe; where it lived many years after tame. I would not be underſtood to affirm that all theſe birds winter in the ſame manner.

The Loxia coccothrauſtes† has come into Scania in Spring for ſome late years, and built there; it paſſes the Winter in Germany, and the ſouthern parts of Europe.

The males of the Fringilla cœlebs‡ are among the firſt birds whoſe notes

* Stock dove.
† Haw finch.
§ White Water wagtail.
‡ Chaffinch.

we hear at the return of Spring; they arrive about the 19th of March, and perch upon trees near the villages, while their females are yet abſent: theſe at length arrive in flocks, which almoſt cover the ſky; and being mated retire to the woods, where they build their neſts. The females, about the 22d of September, fly off into foreign countries; the males remaining behind: they paſs Scania, Denmark, Holſace and Holland, in great flights, in their way to the South of Europe: about fourteen days after Michaelmas they arrive in Holland, where it is a a common amuſement to take them with nets; of thoſe which are caught, ſcarce one in a hundred is found to be a male: they purſue their courſe to Flanders, France and Italy; and Winter being paſt when the thaw ſets in, they return hither in flights.

The Hirundo ruſtica* and urbica† paſs the Winter under water; in the latter part of September they reſort in great flights to the lakes and rivers, a ſingle bird firſt lights upon a reed or bulruſh, then a ſecond and a third, until it be bent down with their weight, and ſinks into the water with them; they emerge again about the ninth of May, at the commencement of the pleaſanteſt part of the year.

CAUSES OF MIGRATION.

§ 6. The cauſes of migration are various, among the firſt we may reckon heat and cold: the aquatic birds form the moſt conſiderable part of thoſe which migrate; theſe are partly birds of the third order (the Anſeres) which living in water, our lakes and rivers being frozen up in the Winter, they can remain here no longer, and are obliged

* Swallow. † Martin.

obliged to deſert us before that time arrives; Partly the Grallæ long legged birds of the fourth order, which get their food in watry places, but being cut off from their proviſion by the rigor of Winter when all the marſhes are frozen, they are compelled by famine to leave their ſummer quarters. The Paſſeres increaſe the number of migrating birds: for the inſects upon which they feed being hidden in Winter, they are no longer able to ſuſtain life with us, and are forced to betake themſelves to other places.

We may ſee therefore that food is another principal cauſe of birds deſerting us in Winter; they being expelled by famine from ſome places, and invited by plenty to others.

This latter circumſtance ſeems very much to determine them in chooſing their ſummer habitations; the Stork, which chiefly preys upon ſerpents, ſeldom viſits us; but

but ſtays the Summer in Scania, where the Coluber natrix*, which is very ſcarce in the northern provinces of Sweden, is found in great abundance. The peſt of Lapland is its immenſe ſwarms of the Culex pipiens† which are there in ſuch numbers that the inhabitants can hardly ſpeak without drawing them down their throats, or open their mouths without their being filled with a whole flight: all theſe exiſt before they come into their flying ſtate in the form of worms, in the waters with which Lapland is flooded, and they are eaten by the Anates§: hence we ſee that a far greater number than are to be found in the ſouthern provinces have choſen this for their breeding place; for while they are hatching their eggs, they can always find food at hand, and they are not neceſſitated to leave them long to cool while they go in ſearch of it: this is eſſentially neceſſary, becauſe there is but one male to ſeveral females, who

*Snake. †Gnat §Duck genus.

who commits all the care both of incubation and bringing up the young to them. The Larus parasiticus* not being able to take fish for himself, gets his living by following others of the same genus which are very voracious; thus when the Clupeæ† are in the Bothnic gulph, these birds repair thither, and subsist in great numbers at the expence of the others.

A number of species of the Grallæ live upon earth worms; and by this circumstance they are obliged in Summer to leave the southern provinces where the dry parched earth affords them no prey, and in Winter the northern where the frost hinders their getting at them.

These are the principal causes of the migration of birds in Autumn; there may be others yet undiscovered by us, as the structure of their bodies with respect to

* Arctic gull. † Herring and Sprat.

to perſpiration and the like; but it is ſtill more difficult to account for their return into our northern tracts at the beginning of Spring and Summer. I ſhould eſteem the numberleſs ſwarms of Gnats (generated in our lakes and rivers, from the immenſe ſnows of the Alps and Lapland being melted in the Spring) among the principal of theſe cauſes, as it ſupplies them with plenty of food.——The long days and bright nights which we enjoy in Summer furniſh them with an opportunity of feeding themſelves and their voracious young: our obſcure and immenſe woods protect them from the buſtle and fear of men, and offer them a convenient refuge and habitation: the heats of the ſouth of Europe compel many who have a thick plumage mixed with down, and particularly the Anſeres*, to ſeek a cooler climate in Summer.——Cuſtom and the place of their nativity has alſo much force in it;

* Order 3. Water fowl.

they return to the places in which they had lived before, which abounded with proviſions for them and their young, and with other advantages to enjoy the ſame commodiouſneſs again. We frequently ſee the Stork year after year hatching in the ſame neſt which ſhe had once occupied; I have obſerved the ſame lame Starling eight years together make her neſt in one hollow alder, though ſhe was abſent all the winter; it is at leaſt ſix years ſince I have noted the ſame Keſtril always returning to lay in one hole in an old tower; and two Moticillæ albæ* have built in a laurel tree in the Phyſic gardens at Upſal for theſe ſix laſt years; they are now become as tame as barn door fowls, not flying from man; which ſufficiently diſtinguiſhes them from all others, as they are generally very timid.

* White water-wagtail.

BIRDS NOT MIGRATING.

§ 7. The birds which do not deſert us are partly birds of prey, and ſuch as feed upon carrion, as the Hawk genus, the Picæ, and others; and partly ſuch as live upon various ſeeds, Corn, the Juniper berry, and the cones of fir: ſuch are the Gallinæ*, and the Paſſeres† with conical beaks, which are able with difficulty to ſupport themſelves in Winter: the long beaked Paſſeres which ſubſiſt upon inſects, depart when they diſappear.

FINAL CAUSE OF MIGRATION.

§ 8. To what purpoſes the divine œconomy has rendered theſe migrations ſubſervient may be difficult to aſſign; without doubt they anſwer many uſeful ends.——Birds in their paſſage furniſh

* Fifth order. † Sixth order.

niſh food to the different nations they viſit, and afford prey to other animals. Gmelin, of late years, has proved by the moſt undoubted evidence, that the Anſeres which in their flight ſubſiſt upon the ſpawn of fiſh, void part of it a day or two after in other waters unhurt, and thus ſerve to diſſeminate the different ſpecies. Some of the order of the Paſſeres devour the ſeeds of plants in great quantities, which they eject again in very diſtant places, without deſtroying its faculty of vegetation: thus a flight of Larks will fill the cleaneſt field with a great quantity of various kinds of plants, as the Medicago lupulina* and others, whoſe ſeeds are ſo heavy that the wind is not able to ſcatter them to any diſtance, and they can only be diffuſed by birds: and we ſhall not be able to aſſign a reaſon why the Alpine plants of Lapland are to be found on other Alps extremely diſtant from that country, unleſs we have recourſe to the ſame cauſe.

The

* Melilot trefoil.

The Stork frees Egypt from frogs and other amphibious animals which cover the ſurface of the ground after the inundation of the Nile; the Falcons deſtroy common and field mouſe in Paleſtine, which Bellonius obſerves to abound ſo much in the parts between Belba and Gaza, that if it were not for their aſſiſtance, the inhabitants would not be able to ſow their ground.

COURSE OF BIRDS.

§ 9. When birds take their flight for the moſt diſtant regions they always move in the ſhorteſt and direct line, and never turn aſide from it: they reviſit their uſual places after a certain and limited time, exactly obſerving the approach and receding of ſeaſons. But we are moſtly ignorant where our own migrating birds go after they have left our limits, and in what direction they ſteer their courſe.

I am

I am inclined to believe that the order of the Paſſeres, with the reſt of the ſmaller birds go from Scania into Denmark and Germany, always purſuing their courſe by the continent: but that the greateſt part of the Anſeres make for Poland and Lithuania, and that many of them purſuing their courſe by the lakes and rivers proceed as far as Turkey: a future age will perhaps be able to determine this, when obſervations ſhall have been made in different parts of the world, and properly compared together.

TABLE

TABLE I.

Obſervations of Cateſby, in Carolina.

Names.	*Summer reſidence.*		*Dep.*
Falco forficatus - —	Carolina ——	p. 4	A.
Pſittacus carolinenſis —	Ditto — -	11	W.b
Cuculus americanus - -	Ditto — —	9	A.
Trochilus colubris - -	Ditto - ——	63	W.b
Anas canadenſis - - -	Ditto, North of -	92	——
—— bucephala - - -	Ditto ditto - —	95	——
Ardea cærulea - - -	Ditto ditto — —	76	——*
—— alba — —	Carolina —— -	77	A.
—— vireſcens —	Ditto —— —	80	A.
Tantalus loculator - -	Ditto, North of	81	——*
Scolopax alba — —	Do. low grounds Ar. S.e.	82	——
Tringa fuſca - - -	*Brown Curlew* —	83	——*
Columba macroura - -	Canada — —	23	——
Alauda alpeſtris ——	Carolina, North of	32	——
Fringilla hiemalis - —	Ditto ditto ——	36	——
——— oryzivora - -	—— ——	14	——*
——— purpurea - -	——— —	41	——
Motacilla ſialis - - -	Carolina, Ar. S.	47	Su.
——— rubra - - -	Ditto, Sp. b. ——	56	W.b
Motacillæ duæ alteræ -	Ditto ditto 66,	53	W.b
Lanius tyrannus - -	Ditto ditto ——	56	W.b
Hirundo purpurea - -	Ditto ——	51	——
Caprimulgus europæus -	Ditto ——	51	——

TABLE

TABLE I.

Ar.	Winter residence.	Ar.	Passage or Rest, and miscellaneous.
----	*Swallow tail Hawk*		
----	The South. *Parrot of Carolina*		
----	*Cuckow of Carolina*		
----	South America	----	*Yellow titmouse.*
W.	Carolina, or south of	----	*Canada goose.*
W.	Ditto - -	----	*Buffel's head duck.*
----	The South. *Blue Heron*	Sp.	Carolina.
----	*Little white Heron Cates*	----	*Great white Heron, Engl.*
A.	The South, *small Bittern*	----	
----	The South - - -	S. e.	Carolina *Wood pelican, goes* Nov.
----	*White Curlew*	----	*Arrives in the rainy season.*
----	South Americ - - -	S. 15.	Carolina, *marshes, goes* Oct. 30.
----	The South, *Pigeon of passage* — —	W.	Carolina and Virginia, *only severe seasons, never returns the same way.*
----	Carolina and Virginia	----	*Lark, goes W. end.*
W.	Ditto ditto, *goes Sp.*	----	*Snow bird.*
----	*Rice bird* — —	Sp.	Carolina; S. Cuba S. 1. Carolina; *Females only.*
----	*Purple finch* — —	W.	South of Carolina.
----	*Blue bird* ———	----	*Summer Red bird.* 56
----	South America —	----	*Cat bird.* 66
----	Ditto ———	----	*Black cap fly catcher.* 53
----	Ditto		
----	*Purple martin*		
----	*Goat sucker* ——	----	*As long as insects appear.*

Catesby mentions other birds, but adds simply that they depart in Autumn.

TABLE II.

Obſervations of Kleinius at Dantzic.

Names.	*Ar.*	*Summer reſidence.*	*Dep.*
Anas anſer			
Colymbus Arcticus		Lapland	*
Lari		Cherſoneſus Heleniſis I. of Nehringa	
Sturna hirundo		Marſhes of Caſubia	W.b
Ardea			
Grues			*
Rallus crex		*Land rail*	
Tetrao coturnix			*
Tringæ	Sp.	Poland and Pruſſia	A.
arquata	A. 15 May	Dantzic, from the N.W.	
Certhia familiaris			
Emberiza nivalis	Feb. Mar.	Lapland	W. b
Caprimulgus europæus		Dantzic	
Luſcinia & Curruca		Dantzic	*
Turdus muſicus iliacus pilaris		Siberia, Lapland	
Sturni		England. *Starlings* Great Poland	
Charadius hiaticula pluvialis			*
Hirundo		*Swallow*	
Ciconia		*Stork*	

TABLE

TABLE II.

Ar.	Wintering place.	Page	Paſſage, or reſt, and miſcellaneous.
----	——— ———	194	Croſs the Baltic. *Gooſe*, Sp. and Aut.
*----	——— ———	----	Dantzic, Sp. and Aut.
----	*Gull.*		
W.	Sound of the Baltic	195	*Sea ſwallow.*
----	Boriſthenes, Eu. Turkey	193	*Heron.*
*----	*Crane* —— ——	92	Whole year in Lithuania, Podolia, Boriſthenes, Helleſpont.
----	England ———	----	*Vide Schenckfelt.*
----	Ukraine, Podolia, Walachia, Sendomiria	190	*Quail.*
A.	England, goes Sp. b. -	187	*Sandpipers various.*
A. e.	North-weſt ——	187	*North in Winter! Creeper.*
----	Carparthian Alps —	186	*Great Brambling.*
----	*Goat ſucker* ——	185	*As long as inſects appear.*
*----	——— ———	283	L. *Nightingale.*
----	Alps, Italy. *M. Throſtle. I. Redwing, P. Field fare* —— —	179	Livonia, Courland, Pruſſia, M. Sep. 21, l. Oct. 5.
----	England. *Willoughby.* Ukraine ——	177	Crimea, ſemicircular courſe: or Lithuania.
*----	Lakes of Lithuania —	175	*Sea Lark. Green plover.*
----	Under water ——	193	*Good authority.*

TABLE III.

Obſervations of Haſſelquiſt, in the Eaſt.

Names.	*Summer reſidence.*
Tringa charadrius - - } Scolopaces variæ - - }	Europe, & Turkey, Greece
Sturnus - - -	France, Italy, S. of Europe
Embediza hortulana - - ſive Ficedula - }	
Charadrius pluvialis - -	*Green Plover*
Tringa vanellus - -	
Anas Boſchas - - } —— penelope - - }	*Mallard* *Wigeon*
Tetrao coturnix - -	Egypt. *Comes Mar. goes Harv. end*
Ardea Grus - - -	Turkey
Pelicanus onocratalus - -	Greece, ſhore of the Black Sea
Monedula pyrrhocorax -	France and England

TABLE

TABLE III.

r.	*Wintering place.*	*Paſſage, or reſt, and miſcellaneous.*
m	Natolia —— —	*Birds from Europe*
b	Egypt —— —	*Do. from Turkey and Greece*
»	Ditto —— —	*Starling.*
p.	Ditto	
w.	Ditto. *Goes Sp. end*	From Sweden?
p.	Ditto - - ——	Ditto? *Lapwing.*
w.	Ditto. *Nile overflows* -	Not from Sweden.
—	—— ——	*Quail.*
ct.	Ditto - - -	*Crane.*
15.	Ditto - - -	*Fly in an obtuſe angle.*
25-5.5	Ditto. *Nile retreated*	*To prey on frogs and amphibious animals.*

TABLE IV.

Obſervations of Ekmarck, in Oſtrogothland.

Names.	*Ar.*	*Summer reſidence.*	*Dep.*
Order I. Accipitres. Thoſe which are birds of prey do not migrate.			
Falco Haliætus - -			
lanarius - -	Sp.b.	Oſtrogothland - -	Oct.
milvus - -			
buteo - -			
tinnunculus -	Ap.b	Oſtrogothland - -	Oct.
albicilla - -	----	Ditto - - -	----
Lanus garrulus -	----	Ditto, North of	----
collurio - -	----	Oſtrogothland - -	----
excubitor -	----	Ditto - -	----
Order II. Picæ. Some migrating, others conſtant.			
Corvus caryocactus -	----	Switzerland, Stiria, Upper Auſtria - -	Aut.
frugilegus - -	Ap.6	Oſtrogoth. river Norcop	Aut.
cornix - -	Mar 19	South provinces of Oſtrogothland, Smoland	W. b
monedula - -	----	Smoland, Oſtrogothland	Aut.
Coracias garrulus -	May 12	Oſtrogothland - -	ditto
Cuculus canorus -	ditto	Ditto ———	Aut.
Jynx torquilla - -	Ap 28	Ditto ———	ditto
Order III. Anſeres, moſtly migrating — Anates, migrate all in Autumn.			
Anas cygnus - -	----	Oſtrogothland - -	----

TABLE

TABLE IV.

Wintering pl[illegible]	*Ar.*	*Paſſage, or reſt, and miſcellaneous.*	*Dep.*
Oſprey —			
Lanner - - -			
Kite - - -	----	*Feed chiefly upon amphibious animals and inſects.*	----
Buzzard - -			
Keſtril - -	----		----
Auſtria - -	----	*In ſevere Winters.*	----
Oſtrogothland. *Comes Au. goes Ap. beg.* - -	----		----
Red backed butcher bird, or Fluſher - -	----	*Seen only in Summer.*	----
Gt. aſh-coloured butcher bird	----	- -	----
Lower Auſtria, *comes Aut.*	----	*Vide Kramer. Nut cracker.*	----
——— ———	----	*Rook.*	----
Sea ſhores. *Royſton crow*	----	*For dead fiſh, &c.*	----
Sea ſhores. *Jack daw*	----	*Ditto, Upſal all Winter.*	----
——— ———	----	*Roller.*	----
——— ———	----	*Cuckoo.*	----
——— ———	----	*Wryneck.*	----
Malmogia, Scania ſhores	----	*Swan.*	----

TABLE IV. *continued.*

Names.	*Ar.*	*Summer reſidence.*	*Dep.*
Anas anſer -	----	Lapland, and more N.	----
bernicla - -	----	Ditto ditto - - -	----
hiemalis - -	----	Frozen ſea - -	----
acuta - -	----	White ſea? - -	----
boſchas - -	Sp.b.	Oſtrogothland - -	----
clangula - -	Mar19	Ditto - - -	----
fuſca - -	ditto	Ditto - - - -	----
querquedula & reliquæ - -	ditto	Ditto - - -	cold
Mergi - - -	May25	Ditto - - -	Aut.
Pelicanus carbo - -	----	Bothnic gulph - -	ſea froze
Alca torda - -	May12	Swediſh iſles - -	S. I
Colymbus arcticus -	----	Sweden and N. provinces	Aut.
auritus - -	----	Lapland lakes - -	----
Lari et Sternæ - -	----	Oſtrogothland - -	Aut.e
Order IV. Grallæ.	----	Ditto - - -	cold
Ardeæ omnes - -	Sp.	Ditto - - -	Aut.
grus - -	Sp.	Ditto - -	----
ciconia - -	Ap.b	Scania - - -	Aug.e
nigra - -	----	O. gothland, North of	----
Rallus crex - -	Jn.10	Oſtrogothland ——	Aut.
lariformis —	----	Sweden, coaſt of -	----
Tringæ omnes - -	----	—— ——	----
pugnax - -	----	Scania - - -	----
vanellus - -	thaw	O. gothland, marſhes	Aug
interpres -	Sp.	Iſles of the Baltic -	Aut.
lobata - -	ditto	Alps of Lapl. and Norway	----
littorea - -	----	O. Gothland - -	----

TABLE

TABLE IV. *continued.*

* *Wintering place.*	*Ar.*	*Paſſage, or reſt, and miſcellaneous.*	*Dep.*
Bays of Holland, or more South *Gooſe* - -	Ap. 6	*Arrive Oſtrogothl. return fly in an obtuſe angle.*	O. 28
Holland - -	Sp.	*Oſtrog. Brent gooſe.*	
Oſtrogothland. *Springs*	----	*In ſevere Winters.*	
South - -	Sp.	*Oſtrogothland, ſtay fourteen days, returns - -*	Aut.
Coaſt of Scania	----	*Winter mild. Duck.*	
Germany, Denmark	----	*Ditto ſevere.*	
—— ——	----	*Some in Winter in open waters. Golden eye.*	
—— ——	----	*Ditto velvet duck.*	
—— ——	----	*Garganey, and others*	
—— ——	----	*Divers.*	
Ocean - - -	W.m.	Sweden. *Corvorant.*	
—— ——		*Lays but one egg. Awk.*	
Hither Germany			
—— ——	----	Sea. *Leſt crefted Diver.*	
—— ——	----	*Gulls and Terns.*	
—— ——	----	*Migrate all.*	
—— ——	----	*In flocks, build always in the ſame neſt. Crane.*	
The South: *Bellonius?*	----	*Stork.*	
Under water: *Kleinus?*			
—— ——	Sp.	*Going. Sweden. return*	Aut.
—— ——	----	*Land rail.*	
—— ——	----	*Never ſeen inland.*	
—— ——	----	*Ruffs and ſandpipers.*	
—— ——	----	*Ruff.*	
Egypt? - -	----	*Lapwing.*	
—— ——	----	*Grey ſcollop toed ſandpiper.*	
England - - -			

*

TABLE IV. *continued.*

Names.	*Ar.*	*Summer reſidence.*	*Dep.*
Charadrius apricarius -	Sp.e.	Oeland marſhes - -	Autb
pluvialis -	late	Oeland ſome. Dalekarlia, near the Alps -	----
hiaticula -	May	O gothland, lakes -	Aut.
Recurviroſtra avoſetta -	Sp.	Oeland, S. point of coaſt	----
Scolopax ruſticola -	Ap 6	O. gothland, woods Auſtria - -	---- ----
Hematopus oſtralegus	----	O. Gothland, coaſts	----
Order V. Gallinæ. Many ſtay the Winter.			
Order VI. Paſſeres. Some migrate, others remain.			
Columba palumbus -	Sp.b.	O. gothland, woods	Aut.
oenas - -	Ap.12	O. gothland - -	Oc.20
Alauda pratenſis - arborea - campeſtris -	Feb.	Ditto - - -	ſharp cold
arvenſis -	firſt	Ditto - - -	S. 22
Sturnius vulgaris - -	----	O. gothland - -	Au 16
		Upſal - - -	later
Loxia coccothrauſtes -	Sp.	Scania. *New there* -	----
eneucleator -	----	Weſtrobothnia Lapland	----
Emberiza nivalis -	----	Lapland alps - -	----
hortulana -	Mar.	O. gothland rare Southern kingdoms -	---- ----
Fringilla cœlebs, mas -	Mar19	O. gothland - - -	latter
femina	Ap.6	Ditto - - -	S. 22
montifringilla	----	Norland woods -	----
cannabina -	----	Oſtrogothland - -	----

TABLE IV. *continued.*

* *Wintering place.*	*Ar.*	*Paſſage, or reſt, and miſcellaneous.*	*Dep.*
—— —	····	O. Gothl. *Green plover.*	····
—— ——	····	*Sea lark.*	····
Italy - - -	····	*Avoſetta.*	····
England } *Woodcock*	····	*Swediſh birds.*	····
Italy }	····	*Auſtrian ditto.*	····
—— ——	····	*Sea pie.*	····
Place unknown, near.	····	*For food not cold. Ringdove.*	····
Sleep in trees -	····	*Stockdove.*	····
—— ——	····	*Tit-lark. P.* / *Wood-lark. A.*	···· ····
Scania? - - - -	····	*Sky-lark.*	····
Ditto - - - }	····	*Stare, or Starling.*	
Denmark Holſatia }	····	*Winter very ſevere.*	····
Germany. S. of Europe	····	*Groſs beak, or Haw finch.*	····
O. gothl. South of -	Oc. 1	*O. Gothland, woods, few days.*	····
Scania - - - -	mid.w	O. gothl. *Gt. Brambling.*	····
Southermoſt of Europe, Africa? *comes Aut.*			
—— ——	····	*Chaffinch.*	····
Flanders, then France and Italy - -	Oc. 16	Holland by Scania, Denmark. Holſace.	····
Brambling, or Mountain finch - -	····	O. Gothl. *Severe Wint.*	····
Greater Red-headed linnet, or Redpole - -	····	*Migrates.*	····
*			

TABLE IV. *continued.*

Names.	*Ar.*	*Summer reſidence.*	*Dep.*
Motacillæ - -	----	Oſtrogothland - -	----
Motacilla luſcinia -	May 17	Ditto - - -	Jul. 12
alba — }	Ap. 12	Ditto - - -	S. 16
flava - }			
oenanthe -	May 9	Ditto - - -	Au. 16
phœnicurus	May 17	Ditto - -	ditto
rubecula -	----	Ditto - - -	Oc. 28
Hirundines - -	----	——— ———	----
Caprimolgus europæus	May 9	Ditto - - -	S. 22

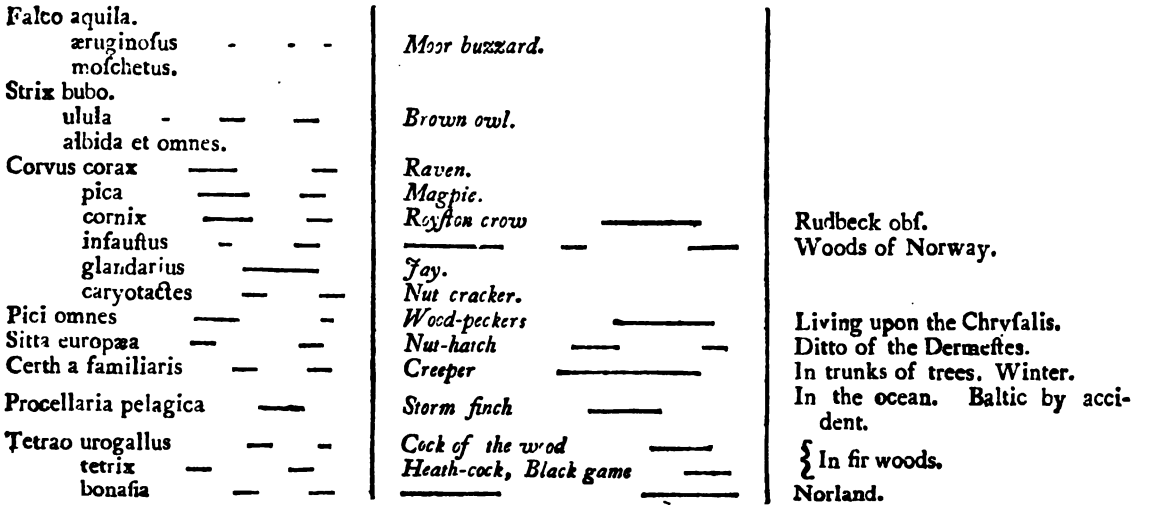
TABLE

TABLE IV. *continued.*

Wintering place.		*Ar.*	*Paſſage, or reſt, and miſcellaneous.*	*Dep.*
			Moſtly migrate? or conceal themſelves?	
			Nightingale.	
			White water wagtail.	
			Yellow ditto.	
			Wheat-ear.	
			Red ſtart.	
			Redbreaſt.	
			Abſent Wint. Food inſects.	
			Goat ſucker.	

TABLE V.

Birds not migrating from Oſtrogothland——from Eknarck



Tetrao coturnix ?	*Quails*	
Turdi omnes.		
roſeus	*Roſe-coloured ouzel*	Never leaves Lapland.
iliacus	*Red wing*	Build in O. gothland——Auſtria Sp. and Aut.
Sturnus cyclus	*Water ouzel*	Open torrents.
Loxia pyrrhula	*Bull finch*	Woods Sum.—Wint. villages.
chloris	*Green finch*	Ditto ditto.
Emberiza citrinella	*Yellow hammer*	Ditto ditto.
Fringilla carduelis	*Gold finch*	Ditto ditto.
ſpinus	*Siſkin, Aberdavine*	Sum. Junipers—Wint. Alders.
linaria	*Leſs red headed linnet*	Ditto ditto.
domeſtica	*Sparrow*	
Motacilla parus		
fuecica		Lapland borders.
Parus		Remains.
major	*Great titmouſe*	Wint. villages.
Hirundo urbica	*Martin*	Wint. under water; appears May 9, goes Sep. 22.
ruſtica	*Swallow*	Hollow trees, ſteeples, Wint.
apus	*Black martin, ſwift*	

DISSERTATION VI.

ON THE

BITE OF SERPENTS,

BY

JOHN GUSTAVUS ACRELL.

Am. Acad. v. 6. p. 197.

SUMMARY.

INTRODUCTION——*no eſſential characteriſtic difference aſſignable between poiſons and wholeſome ſubſtances: Poiſons from the Mineral, Vegetable, and Animal kingdoms——on the defenſive weapons of animals.*

AMPHIBIA, *ſingular properties of ſome genera of this claſs: mode of taking their prey——Boas conſtrictor——Faſcinating power of the Rattle ſnake proved by experiment in England, of the Viper in Italy——of the toad.*

Weapons of Serpents——fictitious ones aſſigned to them——deſcription of the fang of a Rattle ſnake, by Tyſon——Poiſon of Serpents——Experiments of Rhedi, unpoiſoned fangs no effect; needle tinged in the poiſon mortal; poiſon produces no effect in the ſtomach——Hypotheſis of Charas——of the Author——Milk injected into the veins ſudden death, received ſafely in the ſtomach——poiſon of ſerpents analogous——bite produces a true jaundice: ſymptoms of the bite—— Viper, Dipſas, Aſp, Cobra di Capello.

Mode of cure——Extraction of the venom, by Cupping; Oil of Olives, not always ſucceſs-

ſucceſsful; Powder of Senega root; Ophiorrhiza mungos; Snake-ſtone —— on charming ſerpents.

INTRODUCTION.

IF we examine the objects occurring in the three natural kingdoms with a proper degree of attention, we ſhall find that every one of them may be conſidered as either noxious to the health and life of man, or furniſhing him wholeſome nouriſhment and ſupport: from their different effects upon us, we call things of the former kind poiſonous, and of the latter, wholeſome and eſculent; but as every thing in too great a degree becomes hurtful, the moſt innocent and ſalutary food may be converted into the worſt of poiſons: thus wine moderately drunk refreſhes both the body and the mind, and the ſmell of it

applied to the noſtrils recalls thoſe who have fainted away from that temporary appearance of death; but when taken beyond meaſure, nature, by her own proper force, endeavours to free herſelf from it by an acid nauſeous vomit, leſt its corroſive qualities ſhould excite a fever. And we ſee frequent and melancholy examples of the premature deaths of thoſe who indulge themſelves in exceſs of wine. On the other hand, the moſt efficacious remedies are prepared from the deadlieſt poiſons when rightly and ſkilfully applied; thus we have various uſeful medicines from Opium Elaterium, Scammony, Euphorbium and Mercury.

We muſt therefore define a poiſon to be whatever taken inwardly, or applied externally in a very ſmall quantity, by ſome peculiar property produces effects extremely violent, tending to the deſtruction of health and life: but no eſſential difference can be aſſigned between what

is wholeſome and poiſonous, as the moſt wholeſome things become pernicious when uſed in too great a quantity.

The poiſons derived from the three natural kingdoms are as different as the ſources from whence they are drawn; the foſſil kingdom furniſhes us with Arſenic, Orpigment, and many metallic preparations, and among vegetables, the following natural orders, the *Contortæ (a)* as the Aſclepias † and Cynanche, the *Luridæ (b)* as the Hyocyamus ‡, Atropa § and Datura, the *Tricoccæ (c)* as the Euphorbium ¶, the *Multiſiliquæ (d)* as the Hellebore and Nigella, the *Umbellatæ (e)* *m.* as

(a) Thirtieth claſs of the Methodus Naturalis.
(b) Twenty-eighth - - - M. Nat.
(c) Thirty-eighth - - - - M. Nat.
(d) Twenty-ſixth - - - M. Nat.
(e) Forty-fifth - - - - - - M. Nat.

† Dog-bane, various.
‡ Hen-bane.
§ Night-ſhade.
¶ Spurge.

▽ *m.* as the Cicuta*, Sium† and Æthuſa‡, are included among poiſons; and in the Animal kingdom, Serpents, Frogs and Toads.

Having briefly diſpatched this Introductory matter, we now come to conſider the poiſon of thoſe animals, who being armed with different offenſive inſtruments, wound us externally either by puncture or biting.

The weapons with which the wiſdom of our Creator has armed almoſt every ſpecies of animal for its own defence, cannot be ſurveyed without admiration, eſpecially thoſe which are poiſoned: ſome animals annoy their enemies with a bite, as the Bat and the Shrew mouſe: the Trachinus draco§ with his anterior dorſal fin, and many ſpecies of the Meduſa‖ ſting

* Long leaved Water hemlock.
† Water parſnep.
‡ Fools parſley.
§ Weaver, fins venomous.
‖ Sea nettle.

ſting like the nettle: but our admiration is raiſed to the higheſt degree by thoſe weapons infected with the moſt potent poiſon, which are fixed in the tails of ſome inſects, as the Scorpion, the Sphex*, and the Bee, which it is ſufficient now barely to mention, or thoſe placed in the mouths of Serpents: the deſcription of which forms the ſubject of our preſent Eſſay.

THE AMPHIBIA.

Serpents ſtrike mankind, and other animals, with ſuch terror upon account of their poiſon and ſome ſingular properties which elude all the diſtinction of of our judgement, that their unexpected approach alarms even the moſt determined courage. We ſhall premiſe a few particulars upon the nature of this claſs of animals in general. Among the Amphibia

* Berk. 167.

phibia we find ſome genera endued with a very ſingular quality whereby they differ from all others, the greater part of them live indifferently by land or water, many of them for one half the year ſleep in their winter quarters to all appearance dead: their reſpiration differs very much from that of birds and the Mammalia; they draw in air without any reciprocal expiration, at leaſt a ſenſible one: their bodies are of a very rigid nature, abounding with blood, which poſſeſſes a very ſmall degree of heat: the organs of generation in the male are double, a ſingularity occurring in no other animal, unleſs perhaps a few inſects; their natural ſounds are hoarſe, their aſpects ugly, their ſmell fetid. Some of them are oviparous, others viviparous; and by their having cartilagineous bones, every Spring they ſhake off their old age in the manner of the Crab; ſo that there is no definitive bound to their increaſe and magnitude. Their ſingular mode of taking their prey alſo deſerves to be mentioned

tioned, being deſtitute of feet and conſequently not able to purſue it, they lie hidden under the cover of large ſtones and the roots of trees, and darting forward with a ſudden ſpring upon any animal which paſſes by, ſeize and devour it. Travellers into India inform us that the Boas conſtrictor *, the greateſt of all ſerpents, lies in ambuſh among ſhrubs, and ſeizing hares, ſtags, and other animals, ſuffocates them by rolling himſelf round them, and then covering them with his ſaliva, ſwallow them. Theſe animals, as they very ſeldom happen of capture and beſide are not furniſhed with real and proper grinding teeth, have not their jaw bones jointed with the ſame articulation as other animals, but only connected at the baſe with a ligament, ſo that by expanding them they are able to devour the body of an animal of twice their thickneſs, or even more: thus Cleijer relates that the Boas of Java will devour a whole Buffalo, and

* Baldeus Deſcription of Ceylon, chap. 5. 2.

other travellers affirm that he is able to ſwallow a ſtag.

Our own vipers are frequently ſeen with their bellies greatly ſwelled out; and being diſſected, they will be found to contain a frog or a mouſe; I myſelf once diſcovered ſeven young birds in the ſtomach of a viper.

There remains another phenomenon, which is confirmed by the concurrent evidence of ſeveral of our countrymen who have been a long while reſident at Philadelphia; which has not yet been ſufficiently explained; but ſtill requires ſome experiments to be made by perſons in the country, to throw further light upon it. The American Rattle ſnake is the moſt indolent of all the ſerpents; as he lies under the ſhade of a tree, opening his jaws a little, he fixes his eyes which glitter very brightly upon any bird or ſquirrel which is in it; they are endued with a wonderful power of faſcination; the ſquirrel utters a mournful

ful and feeble cry, and as if foreſeeing his fate, leaps from bough to bough on every ſide, ſeemingly to attempt a ſudden eſcape; but ſtruck with an unknown ſpecies of faſcination, he comes down from the tree, and flings himſelf with a ſpring into the very jaws of his enemy. The obſervations of ſome Engliſhmen ſeem to confirm the truth of this; they ſhut up a mouſe with one of theſe faſcinating Rattle ſnakes in an iron box; the mouſe ſat in one corner, and the Rattle ſnake was oppoſite to it, and fixing his eyes continually upon it, by his look alone it was at laſt forced to fling itſelf into the mouth of the ſerpent. The ſame experiment was repeated in Italy with a pregnant female viper with the ſame ſucceſs; and do we not ſee in the Summer a parallel inſtance at home in the toad, a moſt indolent animal, into whoſe mouth, as it lies in the ſhade or under a ſhrub, Butterflies and other inſects fly.

WEAPONS OF SERPENTS.

No ſubject has excited more Philoſophical controverſy than the poiſon of ſerpents, with regard to its nature and mode of operating. Antiquity has not been ſparing in conjecture and fiction upon this ſubject, and its errors have been retained with the moſt reverential obſtinacy by the vulgar: among theſe we are to reckon the fictitious ſting fixed in the tail of the ſerpent as the painters ſometimes have groundleſsly enough repreſented it; ſome have invented a ſimilar fiction of a black forked tongue, which the ſerpent vibrates on both ſides, and have aſcribed its power of producing ſuch noxious effects to this; while others affecting an air of ſuperior diſcernment, have upon equally good reaſons aſcribed it to the teeth in general: theſe are all errors of a magnitude that the moſt deſultory attention to the ſubject would have been ſuf-

ſufficient to have removed. There is a very ſmall bone cloſely fixed to the upper jaw, in the inſide of the lip of a poiſonous ſerpent, which has a power of moving backward or forward; to this two or three fangs are annexed larger than the teeth, which the ſerpent, by its aſſiſtance, when enraged darts forward, or withdraws and conceals at his pleaſure, in a ſimilar manner to the claws of a cat: theſe fangs, which the common people name the large teeth of the ſerpent, are excellently deſcribed by Tyſon in the Anatomy of the Rattle ſnake, which he has given in the Philoſophical Tranſactions. "*In theſe (the fangs) we* "*obſerved a conſiderable cavity near the* "*baſe; and near the point a very diſ-* "*cernible fiſſure of ſome length like the* "*ſlit of a pen: the part of the tooth from* "*the fiſſure to the root was manifeſtly chan-* "*nelled, which we firſt diſcovered by lightly* "*preſſing the gums; we then ſaw the* "*poiſon aſcend through the cavity of the*

"*fang*

"*fang and flow out of the fiſſure; and as*
"*theſe fangs are ſo very acute, ſo firm*
"*and ſolid toward the point, (the fiſſure*
"*being on the external and convex, not the*
"*internal ſide) nothing could be conceived*
"*more convenient either for inflicting a*
"*wound, or to inſure the infuſion of the*
"*poiſon.*" Each of the fangs is ſurrounded with a veſicle furniſhed with glands ſecreting a certain fluid; which upon the veſilce being preſſed, ſeems to flow out of the point of the fang. The ſerpent when incenſed, raiſing his head, extends the ſmall bone armed with the fangs mentioned above; and attacking his enemy with a force combined of the weight of his body, and the action of the muſcles, he wounds him with the expanded fangs, and the veſicle being compreſſed, the poiſon immediately flows into the wound: this is clear from the experience of thoſe who having broken off their fangs with a pair of forceps, handle the ſerpent thus diſarmed without any hurt.

hurt. And as the North Americans, after carefully extracting theſe venomous fangs, ſuffer the Rattle ſnake to bite and gnaw them with his teeth till the blood flows freely, with total impunity; it is certain thoſe people are deceived who attribute the fatal effects of his bite to thoſe hurtleſs weapons.

POISON OF SERPENTS.

Thus far we have conſidered the mode in which ſerpents inflict a wound; we muſt now convert our attention to the origin and nature of the poiſon injected into it.——Antiquity amuſed itſelf with a fable deſtitute of all appearance of truth, that anger was excited by black bile: they applied this fiction without heſitation to the preſent ſubject, and founded an hypotheſis upon it to account for the effects of the bite of an incenſed ſerpent; pretending to have diſcovered an ideal canal

canal which conducted the bile from its veſicle to the mouth of the ſerpent, whence it flowed into the part bitten, and produced the moſt fatal ſymptoms. But diſmiſſing theſe dreams of antiquity, let us review what the more cautious and attentive examiners into nature among the moderns have delivered upon this ſubject. Toward the end of the laſt century when Medicine as well as the other ſciences received ſuch abundance of new lights by the diſperſion of thoſe clouds of conjecture and hypotheſis which hung over them, this ſubject was greatly illuſtrated under the auſpices of Ferdinand the Second, Great Duke of Tuſcany: this Prince to whom literature will be ever indebted, deſirous of enquiring into that myſterious queſtion the nature of ſerpents, invited Steno, Rhedi and ſome other philoſophers of the firſt eminence to his court: and a multitude of the moſt poiſonous ſerpents being collected, Rhedi made ſeveral experiments upon them, which diſ-

covered

covered to him a number of particulars before unknown, of which the following ſeem to have the beſt claim to our attention. When he either cauſed a living viper to bite a dog, or wounded him with the teeth of one newly dead (the poiſonous veſicle remaining unbroken) the event was the ſame. If the bite was repeated, its effect became weaker and at laſt was loſt, the poiſon contained in the veſicle being totally exhauſted.——That the teeth of ſerpents when extended to bite were moiſtened over with a certain liquor; and when the veſicle at the baſe was preſſed, a drop of poiſon flowed to the point of the fang. When the poiſon thus flowing from the veſicle was received in ſoft bread or a ſpunge, an animal bitten by the ſerpent received no more harm from the wound than from being pricked by a needle, till after a few days, when the venom was reſtored afreſh: but when an animal was wounded with the point of a needle dipped in the poiſon, it was tormented with the ſame pains as if it had been bitten by the

viper itſelf. Preſerving ſome of this poiſon in a glaſs and totally evaporating the moiſture in the ſun, when the reſiduum was diluted again with water, and the point of a needle dipped in the ſolution, Rhedi found to his great ſurpriſe that it had the ſame effect as when recent. But the boldneſs of Tozzi, one who charmed vipers, flung all theſe men who were deeply verſed in Natural Philoſophy into the utmoſt aſtoniſhment; they happening to fall into diſcourſe (while the Prince was preſent) upon the certain death which would attend any perſon's ſwallowing this poiſon of the viper by miſtake, inſtead of ſpirit of wine or water; Tozzi confiding in his art, drank a conſiderable portion of it without heſitation: they were all aſtoniſhed at his apparent raſhneſs, and predicted inſtant death to the man, however he eſcaped as ſafely as if he had drunk only ſo much water. This event, which ſtruck the Prince and his illuſtrious aſſociates in theſe philoſophical inquiries by its novelty, was well known to the ancients;

Lucan,

Lucan, in the 9th book of the Pharſalia ſpeaking of the ſerpent, ſays,

Noxia ſerpentum eſt admiſto ſanguine peſtis
Morſu virus habent, et fatum dente minantur,
Pocula morte carent. Phar. l. 9, v. 614.

Mixed with the blood that venom ſlays alone,
His bite is poiſon, death is in his fang,
Yet is the draught innoxious.

Nor muſt we omit obſerving, that barbarous nations are perfectly acquainted with the property of the poiſon of ſerpents by which it retains its deadly power after it has been long kept: they have been poſſeſſed of this fatal ſecret for ages paſt; it being their cuſtom to tinge the points of their arrows with the juice of ſpurge, putrid fleſh or oil of tobacco, but more particularly with the poiſon of vipers. Some modern Indians continue the practice to this day; and we have the teſtimony of Pliny in his Natural Hiſtory, that the Scythians had long ago the ſame cuſtom: "the Scythians (ſays that author) dip their arrows in the poiſon of vipers

and human blood, a horrid practice, as the ſlighteſt wound inflicted by one of them defies all the art of medicine."

But to return to our Florentines, that they might confirm this principle with undoubted and new experiments, having collected a quantity of the poiſon they gave it to different animals to eat in different modes, who all took it without any appearance of danger: but when it was applied to an external wound it produced every one of thoſe horrid ſymptoms which accompany the real bite, inflammatory and malignant fevers, ending in death; unleſs nature, by a ſpontaneous hemorrhage or ſome other evacuation, diſcharged the peccant matter. Their experiments opened the way for us to penetrate with greater certainty into theſe hidden parts of nature.

While Rhedi and his aſſociates were thus buſied in Tuſcany in tracing the footſteps of Nature cloſely and ſucceſsfully under the guidance of experiment, the

the Philoſophers of other countries amuſed themſelves with forming new conjectures and fictions. In France, Moſes Charas, firſt ſurgeon to the King, a man of conſiderable reputation, writing upon the theory of ſerpents, endeavoured with all his weight to prove their poiſon "to conſiſt in heated animal ſpirits, and "therefore that it is impoſſible for a "viper to give a deadly wound unleſs it "had been before incenſed." We ſhall not go about to deny that the mental affections can generate ſomething ſimilar to a poiſon; the face of a man in anger changed to a ſublivid colour indicates ſomething like it: Men ſtruck with a ſudden terror frequently turn pale, and the humours lodged in the inteſtinal canal are evacuated by a diarrhœa; but this is evidently diſcovered in Nurſes, whoſe milk becomes poiſonous when they are greatly irritated, and if it be then taken by a child, provokes a diarrhœa which frequently terminates fatally. But however this may be, the hypotheſis of Charas can receive but little ſupport from

from it, as that vague doctrine of animal ſpirits and their irritation, however it might afford a commodious and decent retreat to ignorance formerly, is now ſuffered to ſubſide in a very undiſturbed oblivion.

Diſmiſſing this fanciful hypotheſis, I think now it time to lay down my own opinion upon this ſubject; and although in a matter of ſo much obſcurity it is more difficult to eſtabliſh a new ſyſtem upon affirmative proof, than to deſtroy an old one, yet as ſomething muſt be laid down though it may not be abſolutely deciſive and exclude all further reſearches, it will be beſt to proceed upon ſuch principles as bear at leaſt an outſide of truth, and a certain degree of analogy to what experiment has already diſcovered. With this belief we ſhall proceed to lay down thoſe particulars which have tempted us to hazard a new hypotheſis. In the laſt century the Phyſicians (and thoſe of England

land in particular) being deſirous to diſcover a new way of adminiſtering medicines, and that the action of medical ſubſtances ſhould not loſe their efficacy by their intricate progreſs through the ducts of the Chyle, invented a mode of exhibiting medicine by infuſion, which they cultivated with great eagerneſs: this was performed by injecting the medicine into an opened vein. The partizans of this invention extolled it unboundedly; but if in ſome inſtances it was not unattended with ſucceſs, the event was generally the contrary; either becauſe they made uſe of new drugs whoſe efficacy had not been aſcertained by any experiment, or that they did not proceed with ſufficient caution in this mode of applying old ones. It is no great wonder that the infuſion of diſtilled ſpirits was mortal; but men could not ſee without aſtoniſhment that even milk itſelf infuſed into the veins, though it be the nouriſhment of man in his infancy, produced ſudden death; of which

we can hardly aſſign any other cauſe than that which offers itſelf at the firſt view; the immediate mixture of milk with the blood, without the intervening aſſiſtance of the inteſtines, which nature repugnant to heterogeneous mixtures could not ſuſtain. If men of erudition and ſcience be diſpoſed to admit this deduction, there will be little difficulty in diſcovering an analogy between this infuſion of milk and the poiſon of ſerpents; at leaſt nothing has yet been advanced upon this ſubject which carries a ſtronger appearance of truth and probability with it. Let us ſuppoſe a minute portion of the poiſon of a viper applied to a wound, it is abſorbed by the veins and mixed with the blood; by that mixture the total maſs of blood becomes by degrees corrupted; for as a ſmall particle of leaven throws a great maſs of paſte into fermentation, and a minute part of this is ſufficient to leaven another, and ſo on indefinitely, thus by the multiplicative force of nature

ture we may ſuppoſe, without abſurdity, that the poiſon joined with the blood becomes in a ſimilar manner increaſed and corrupts the whole; whither this be effected by coagulation, comminution, or any other mode we are not able to determine. Ray, in his Hiſtory of Quadrupeds, (p. 317) relates a very ſtriking experiment relative to this matter; a gentleman reſident in India, having company at his houſe, ſent for one of thoſe natives who carry about different kinds of ſerpents, to ſhew them ſome experiments upon the difference of their poiſons; a common cuſtom in India. The firſt ſerpent he produced was of a very large ſize, which he affirmed to be perfectly harmleſs: and to declare his aſſertion, making a ligature upon his arm, he provoked the ſerpent to bite him; and collecting the blood which flowed from the bite to the quantity of half a ſpoonful, he ſpread it upon his thigh: he then produced a ſmaller called the Cobra de

capello (Coluber naja) and gave an account of the dreadful power of its poiſon: and to prove it by experiment, holding the neck of the ſerpent very tight, he preſſed out of the veſicle of the jaws about half a drop of its contents, and put it upon the coagulated blood upon his thigh: immediately upon the mixture, a great ebullition and efferveſcence enſued in the manner of a fermentation, and the blood was inſtantly changed into a yellow fluid. From this we derive ſome light into the mode of the operation of this poiſon; and it confirms that celebrated obſervation, that the bite of a viper produces the jaundice.

When we compare this hypotheſis with the experiments of Rhedi and Tozzi, we find that it admirably agrees with them: with reſpect to Rhedi, every one of his obſervations prove that the liquid preſſed out of the veſicle which moiſtens the fangs of the ſerpent is only noxious by being

being conveyed into the blood by means of a puncture or wound: and the caſe of Tozzi, who drank a conſiderable quantity of this poiſon without ſuffering the leaſt injury from it, proves that it hurts the blood only when externally mixed with it. There is another circumſtance which points out the ſame reſult, that animals ſlain with arrows poiſoned by this liquid may nevertheleſs be ſafely eaten: we have no other grounds on which to explain this wonderful event, than the effect of the immediate mixture of the venom with the blood, aſſiſted perhaps by fermentation; and thus different ſymptoms may ariſe from the bite of different ſpecies of animals. We confeſs ourſelves unable to aſſign the particular cauſes from which theſe diverſities ſpring, nor do we think ſuch an account can with propriety be demanded from us.

SYMPTOMS OF THE BITE.

It remains for me to give a brief and general deſcriptive account of the various effects of the bite of different ſerpents.

The ſymptoms that attend the bite of the Viper are a ſmarting in the part wounded as if it were continually pricked with needles, ſwelling, paleneſs, ſnapping of the eyes, tears, horror with coldneſs, a weak pulſe afterwards becoming unequal, thirſt, cold ſweat, pain in the reins, diarrhoea with griping and vomiting, difficulty of breathing, drowſineſs, and convulſions, which terminate in death.

We are ignorant of what ſpecies the Hemorrhois was, which is deſcribed by Lucan as cauſing by its bite a flux of blood from every part of the body*.

The

* See Note (*A*) at the end of this Eſſay.

The Dipſaſas is at preſent likewiſe unknown, Lucan informs us that the perſon wounded by it was attacked by an unquenchable thirſt; this is finely painted by him, where A. Tuſcus, ſtandard bearer of Cato, is deſcribed as bitten by that ſerpent:

Non Decus imperii, non mœſti jura Catonis
Ardentem tenuere virum, quin ſpargere ſigna
Auderet, totiſque furens exquireret agris
Quas poſcebat aquas ſitiens in corde venenum.
Pharſal. l. 9.

His wild impatience, not his honoured ſtate,
Nor ſorrowing Cato's high command reſtrain;
Furious, diſhonoured in the duſt he flings
His ſacred eagle, and o'er all the fields
Rapid he burſts to ſeek the cooling ſtream
To quench the thirſty poiſon in his breaſt.

And a few verſes after

Scrutatur venas penitus ſqualentis arenæ
Nunc redit ad Syrtes, et fluctus accipit ore,
Aquoreaſq. placet, ſed non ſibi ſufficit humor,
Nec ſentit fatiq. genus, mortemque veneni,
Sed putat eſſe ſitim; ferroque aperire tumentes
Suſtinuit venas, atq. os implere cruore.

Now

Now tearing up the ſands ſome latent vein
Fruſtrate he ſeeks, now to the Syrtes ſhore
Returned he ſwallows down the briny flood
Mixed with its rolling ſands; nor knows his fate
And the ſad poiſons death, but calls it thirſt;
Then with his ſword opens his ſpouting veins
And drinks the burſting blood.------

In the monuments of antiquity we find three ſpecies of Aſps:

1ſt. The Phtyas, with a callous caruncle on its forehead, its colour is cinereous, with a ſhining green.

2nd. The Cherſea is very long, cinereous, inclining to green; its eyes red.

3d. The Chelidonia is black, with a white belly: its bite is ſaid to produce two or three hiccoughs, change of colour, ſtupor, cold, and ſleep with palpitation: upon a compariſon of what authors have written upon theſe aſps, I am fully perſuaded that the Phtyas which kills by bringing on a lethargic ſleepineſs is the ſame ſerpent which obtained the ſpe-

cific name of the Aſpis among the ancients, and that it is the Nintipolonga Zeylanica of Bellonius* and Ray, and the Amodytes of the Syſtem of Nature. The Phtyas ſeems to have been the ſerpent made uſe of by Cleopatra to deſtroy herſelf; this woman, to terminate a diſſipated life with an eaſy death, ordered her phyſicians to prepare a poiſon for her which might beſt effect this purpoſe: they having tried a number of different experiments upon condemned criminals, at laſt diſcovered this ſpecies of Aſp, which brings on death without any previous appearance of diſtemper or hiccough; the face ſeems in a ſlight perſpiration, an eaſy inſenſibility and lethargy creeps upon the whole frame, and the perſon bitten ſeems almoſt totally ignorant of his approaching diſſolution: having acquainted the Queen with their diſcovery, ſhe applied the Aſp either to her boſom or her arms, or according

* Bell. Itin. p. 203-----Raj. anim. p. 332-----Syſ. Nat. 216. No. 173.

cording to ſome authors dipping the point of a needle in the poiſon and pricking herſelf with it ſhe expired in an eaſy ſleep. Moſt of the Colubri mentioned in the Syſtem of Nature are poiſonous, and perhaps all the Crotali; among theſe are reckoned

Vipera*,	Myćterizans,
Berus,	Leberis,
Lebetinus,	Preſter†,
Naja,	Stolatus,
Dipſas,	Niveus,
Atropos,	Amodytes,
Cherſea,	Aſpis,
Severus,	Lacteus,
Atrox,	Corallinus.

The bite of the Naja is ſo fatal that a man dies by it in the ſpace of an hour, his fleſh entirely falling off his bones in a ſemi-diſſolved putrid ſtate; this makes it probable that it is the ſame ſerpent which the ancients named the Sepe. It is

* Viper. † Black viper.

is not neceſſary to enumerate any more though a number of different ſpecies might be mentioned whoſe poiſons all produced different effects: yet with this diverſity they all agree in one particular circumſtance, that their venom is not fatal unleſs introduced into the blood externally: it now remains to conſider the remedies againſt theſe poiſons*.

CURE.

We ſhould extend this eſſay to an enormous length if we were to attempt to relate all thoſe antidotes which men compelled by ſo fatal a neceſſity have employed againſt the bite of ſerpents: we ſhall confine ourſelves only to ſome principal ones, and ſuch as are recommended by the probability of uſe; the firſt in point of antiquity, and which recommends itſelf alſo to us by its certainty, is to draw the venom out of the wounded

* See Note *(B)* at the end of this Eſſay.

part as quickly as poſſible; this has been attempted by different methods, the moſt ancient is ſucking it out by the mouth: yet the utmoſt precaution is neceſſary in the perſon who performs this operation that his mouth be perfectly free from the ſcurvy, and that the ſkin of the fauces be entirely unbroken; leſt he ſhould incur an equal hazard, or perhaps a greater, as the poiſon muſt attack a nobler part: therefore as the operation is nauſeous and full of danger, it will be better to ſcarify the part with the knife, that the infected blood may have a freer exit from the opened mouths of the veſſels, and to apply a large cupping glaſs, by means of which the remaining venom may be extracted; then to foment the part with warm emollient applications joined with ſome ſpirit, as the ſpirit of Sal ammoniac*, or Theriacum: if theſe be not at hand, apply ſoap and vinegar to the wound: the patient may take ſudorific and exciting medicines

* See Note *(C)* at the end of this Eſſay.

dicines internally, by which I mean emetics, or Ipecacuanha; and the ſtronger ſudorifics are exhibited with great ſucceſs. But the preſent age has added antidotes of three different ſpecies to counteract the moſt vehement effects of this poiſon, of which Europe, Aſia and America, has each furniſhed us with one.

Among the Europeans there has been a ſtrong predilection in favour of the oil of olives, or any other expreſſed oil: this is directed to be drunk plentifully by the patient, to the quantity of half a pound, or more, while the wounded part is copiouſly bathed by it: very full accounts of the happy effects of this treatment are inſerted in the Philoſophical Tranſactions of London, and the Memoirs of the Academy of Paris. We are ſo far from detracting from the merits of this medicine, that we think it ſpecific againſt the bite of the Common and Black viper; yet we muſt add, that the na-

ture of this antidote is not yet thoroughly inveſtigated and underſtood; and that we dare not pronounce ſentence upon its efficacy and uſe in every ſingle and particular caſe. Our illuſtrious Preſident, Linnæus, being in Scania, was applied to by a woman who was bitten by the Cherſea; and notwithſtanding he cauſed her to drink this oil according to the preſcribed forms, ſhe nevertheleſs expired in the greateſt agonies: this account I received from himſelf. May not this oil fail when applied againſt the bite of ſome of the European ſpecies of ſerpents? or is there not ſome neceſſary obſervations omitted in the formula delivered, either reſpecting the medicine or the patient: this we leave and ſtrongly recommend to the experience of others to determine.

Let us now proceed to the American antidotes, of which the Powder of the Senega root deſervedly claims the firſt place: the

uſe

uſe of this root has been known to the natives of the woods of North America for many ages paſt; its effects againſt the bite of the Rattle ſnake almoſt exceed all belief: But the invidious prejudices of thoſe Barbarians preſerved this ſecret with ſo obſtinate a ſilence that no bribe could purchaſe it from them, until Tennent happily diſcovered and publiſhed it for the benefit of mankind. He tells us that the root of the Polygala ſenega never fails of ſucceſs unleſs where ſome large veſſel is wounded, when the medicine has not time to counteract the rapid progreſs of the violence of the poiſon.---- Upon this ſubject the Reader may conſult the Diſſertation upon this plant in the ſecond volume of the Amænitates Academicæ. In Sweden we have had only one proof of its efficacy, but which highly deſerves to be mentioned; a maid ſervant at Upſal was bitten by a ſerpent upon a very dangerous place, the moſt dreadful ſymptoms followed the bite, and

ſuch

ſuch as demanded the application of the moſt deciſive remedies: our Preſident was ſent to, who immediately diſpatched two doſes of the Powder of this root (all he had in his poſſeſſion) which was attended with ſo good an effect, that in two days ſhe was almoſt completely recovered. It is much to be wiſhed that neglecting all trifling palliatives of a dubious efficacy this excellent powder was introduced into our ſhops. Beſide this root the Americans have many other plants which they apply upon the ſame occaſion, as the Eryngium fœtidum*, aquaticum†, Veratrum luteum‡, Aletris farinoſa§, Uvularia perfoliata‖, Sanicula canadenſis¶, and the Ariſtolochia ſerpentaria**: but we ſhall diſmiſs theſe with a long catalogue of others whoſe virtues are not yet well known to us.

We

* American fetid Eryngo.
† Virginian aquatic ditto.
‡ Virginian yellow flowered Ver.
§ Floridan aletris.
‖ Virginian perfoliate Uv.
¶ Canadian ſanicle.
** Virginian ſnake root.

We come now to another antidote of equal celebrity, that made uſe of by the Aſiatics, which is of the greateſt antiquity among the Indians, the Ophiorrhiza mungos*. Kæmpfer has given us the the hiſtory of this plant and its unequalled virtues againſt the bite of the Coluber najas†, we ſhall not here attempt a deſcription of it, as it has been already done in a very elegant Diſſertation by Darelius. We ſhall only hint that as the efficacy of this medicine is ſo great, it would be much ſafer to introduce that, or the true Lignum colubrinum inſtead of the Strycnos colubrina‡ into general practice, whoſe uſe, if it have any, is is extremely ambiguous.

The ſnake ſtone called the Pedra de cobras di capello (as if it were a ſtone extracted from the head of the Coluber naja) is very famous throughout all India, and is extolled

* Indian ophiorrhiza. † Cobra di capello.
‡ Indian ſtrychnos.

tolled by Garzia, Kircher, and others, as a ſpecific againſt the bite of ſerpents: it is pretended that if it be applied to a poiſoned wound, and ſuffered to remain upon it until it fall off of itſelf, that it will extract all the venom: but its uſe has been ſuſpected by many, nor did it ſucceed with Rhedi, who tried a variety of experiments with it; many have been of opinion that the ſtone is artificial, and nothing more than the calcined horn of a hart*.

CHARMING SERPENTS.

Pliny, Ovid, and many of the ancients inform us, that the Ophiogenes of Aſia, the Pſylli of Lybia, and the Marſi of Italy were celebrated for charming ſerpents, and curing their bite: theſe people handled the moſt venemous ſerpents without receiving any hurt, and healed their bites by ſucking out the poiſon. Haſ-

* See Note (*D*) at the end of this Eſſay.

Haſſelquiſt relates as an eye witneſs that ſuch a claſs of people ſtill ſubſiſt and exerciſe their art to this day in Egypt: its ſecrets are preſerved with the greateſt fidelity, nor has any bribe been able to prevail upon them to diſcloſe them. The common people entertain an opinion that if a man faſting ſpits upon a ſerpent, the ſaliva kills it before the evening; Pliny has mentioned the ſame circumſtance, and the Viverra mungos, when he is going to encounter a ſerpent, is ſaid to eat Rue, (this animal is known on ſuch an occaſion to eat the Ophiorrhiza*)——does the chewing Rue add ſuch a quality to its ſaliva, that when it falls upon the ſerpent it renders him paralytic, and ſo unable to draw himſelf back to inflict a wound? Jacquin, who is upon his return from India, has informed the Preſident, by letter, that he has purchaſed the ſecret of charming ſerpents; we are yet ignorant whether this is effected by chewing the plant which

* Indian ophiorrhiza.

he has named the Ariſtolochia anguicida*, or by ſome other means: but we hope that Jacquin will ſoon reveal this ſecret to the wiſhes and curioſity of the cultivators of Natural Hiſtory.

* Mexican Ariſtolochia.

(A) The bite of an American ſerpent named de la Crux kills in the ſame manner as that of the Hemorrhois.

(B) The experiments of Rhedi have not, in the opinion of ſome celebrated philoſophers, ſo far cleared the theory of the operation of the poiſon of the Viper, as to leave nothing further to be deſired upon that ſubject: Fontana and Carminati have endeavoured to inveſtigate its operations more clearly: what Fontana has done I have not yet ſeen, but Carminati, from eleven experiments, deduces the following concluſions:

1. That if poiſon be inſtilled into a nerve, the animal wounded dies almoſt inſtantly, and the whole nervous ſyſtem to which it is rapidly conveyed is deprived of its quality called ſenſibility.

2. If a muſcle be wounded it is deprived of its irritability,----this is confirmed by the experiments of Fontana.

3. The

3. The poiſon injected into a wounded muſcle or tendon is conſiderably longer in killing an animal than that introduced into a nerve.

4. The ſymptoms which precede the death of the animal bitten are a ſtupor, lethargy, tremors, convulſions, paralyſis of the legs (part wounded) intire diſſolution of the limbs.

The blood is not always coagulated, nor its craſis diſſolved;-----marks of inflammation are ſometimes diſcovered in certain parts of the animal after death, ſometimes not; theſe are the effects of ſpaſms and convulſions, not of the poiſon.

5. Not the leaſt ſign of the jaundice was diſcoverable in the eyes of any of the animals upon which Carminati made his experiments.

6. The ſtomach in every one of them was very much inflated, a ſymptom remarked only by Fallopius and Albertini.

7. A ligature applied inſtantly above the part bitten if it be ſo placed as to admit one, was found by ſome experiments a good preventive againſt the diffuſion of the poiſon: its compreſſion ſhould be conſiderable but not exceſſive.

Opuſc. Scelti ſulle Scienze. Milan, 1778, p. 38.

(C) The volatile alcali of which is diſtilled from the horn of the ſtag in great quantities, is a very powerful antidote againſt the poiſonous bite of the viper, and was adminiſtered very happily by Juſſieu.

(D) The Abbè de Termeyer, who had lately made ſome experiments upon this ſubject, entirely embraced

this opinion. His artificial ſnake-ſtone was formed of the bottom of a ſtag's horn, reduced to a regular form, and burned until it became black, and its ſubſtance could be grated away with the nail. Some trials made at Milan greatly favoured the reputation of the artificial ſtones----he ſucceeded (repeatedly trying the experiment on a very large ſcale) before Signior Moſcata, Regius Profeſſor of Chymiſtry, and before the Faculty of Medicine of that univerſity----and the inſtances of its ſucceſs were ſo conſtant and numerous, as to give the ſemicalcined horn the appearance of a reputation which never could be ſhaken, yet upon continuing theſe trials it afterwards failed as generally.

Roſier's Journal----Scelta d'opuſc. Milan, 1778.

ON

DISSERTATION VII.

ON

INSECTS,

ORATION,

By *LINNÆUS.*

Am. Acad. v. 2. p. 356.

SUMMARY.

Mutual utility of animals——Philoſophy formed from the union of many ſeparate diſcoveries——Man excels other animals in reaſon——object of reaſon the kingdoms of nature——uſe of ſuch purſuits

purſuits——Of the ſtudy of inſects—— inſects firſt defined by Linnæus —— their metamorphoſes——elegance and ſingularity of their forms and parts—— the multiplication of Bees——Ants—— Aphides —— Galls of vegetables —— Rhendeer Breeze——Lice of beaſts, Birds, fiſhes, enumerated by Rhedi——Kermes of the alder——of other ſingular inſects ——the increaſe, manner of life, Anatomy, ſhell, renewal of loſt parts of ſome ſpecies of crabs——mode of ſome inſects to conceal themſelves from birds, &c.—— Indian creeping leaf —— Lion-piſmire ——Luminous inſects——inſects armed with claws, ſtings——ſpinning. Species hurtful to plants——to men——Oriental Blatta —— poſſible advantages of purſuing this ſubject——Inſtruments in the hands of Providence to puniſh mankind —— damages received from ſome ſpecies——Cauſe of epidemical diſorders? Concluſion.

THE

THE end of Nature in the creation of every diſtinct ſpecies of animal is not excluſively confined to its own well being, it is alſo ſubſervient to that of man and other animals.

Various fiſhes at certain and determinate ſeaſons of the year abandon the ſecurity of the deeps, and truſt themſelves to the danger of ſhallower waters; they penetrate up the rivers, and move from promontory to promontory upon ſtated days and months, that they may be taken in ſhoals by many birds and beaſts.

The Merganſeres* ſweep the open ſea in regular order to drive the fiſh aſhore that we may make an eaſy capture of them; the Lari† hover over their ſhoals all day, and betray their courſe: the Graſshopper of Surinam furniſhes man with light by night, the ſilk worm ſpins his thread to cloath him in ſilk, the Bee collects his honey to gratify his palate,

Not

* Gooſeander. † Gull.

Not for yourſelves your citadels ye rear,
Nor you, ye ſheep, your fleecy burthens bear.

In the Mechanic arts the union of many artificers muſt concur to finiſh any complicated work: it is the ſame in Science; the united or ſucceſſive diſcoveries of a number of individuals are neceſſary to point out all the advantages which nature ordained the animal creation to yield us.

Each animal has its diſtinct properties by which it excels the others; man's ſuperior advantages are derived from ſuperior reaſon; this therefore we ought to cultivate and exerciſe beyond all others,

The reſt is death's,----by wiſdom man alone
Survives himſelf, and makes all time his own.

It is that which enables us to perform the moſt ſignal ſervices to our fellow creatures: but on what objects is this reaſon to be exerted to attain this end? by thoroughly inveſtigating the properties of thoſe things we are ſurrounded with; the Stars, Elements, and Natural Bodies.

Bodies. The Mathematician conſiders the Stars, the Phyſical Philoſopher the Elements, and find Heaven and Earth full of the glory of the Divine Being: Let us turn our eyes to the objects we live ſurrounded with, and examine them as Lithologiſts, Botaniſts, or Zoologians, we every where find the conſummate wiſdom of the Divine hand which formed them fully impreſſed upon them.

Theſe are the three departments in which we ſhall labour with moſt ſucceſs to promote the general utility; theſe open a ſcience to us which we ought to inveſtigate and apply with the greateſt aſſiduity; it ſupplies us with new foods and medicines, lays open the wonders of the wiſdom and power of the Creator, and fills the mind with an ingenuous pleaſure and delight which is not ſurpaſſed by any other: it would be too prolix to attempt to go into the whole of this ſubject, I ſhall therefore dedicate the preſent hour to entering into thoſe receſſes in which

nature has ſecluded the leaſt of the claſſes of animals.

In this low and deſpiſed rank of living beings, I mean inſects, we diſcover the moſt perfect mechaniſm of Nature.---Small as they are, and without the gift of ſpeech, they proclaim the wiſdom of the Creator as clearly as his other works: Men, notwithſtanding their thirſt for novelty, have thought them ſo far beneath their notice, that among all Sciences that of the Nature of Inſects has been leaſt cultivated; Liſter, Swammerdam, and Reamur, with a few other ancient and modern writers, have diligently examined ſome particulars relating to them; yet nobody had diſtinguiſhed that eſſential character by which they differ from Quadrupedes, Birds, Fiſh, or Worms: The Crab was claſſed with fiſh, which notwithſtanding is an inſect, and the Hippocampus, a fiſh, was ranked with inſects. The Meduſa*, the Cockle, the Earth worm,

* Sea-nettle.

worm, even Zoophytes, and ſome other claſſes of worms were likewiſe confounded with them.---This confuſion univerſally prevailed, untill I demonſtrated in the Syſtema Naturæ, that of all animals inſects only were furniſhed with antennæ, and that their ſceleton was nothing elſe than a ſkin or Epidermis.——Thus theſe minute animals, clad in a complete ſuit of armour, were preſerved from all external injuries. The ſtrength of the Elephant in proportion to his magnitude, is nothing in compariſon of one ſpecies of the Scarabæus*.

Conſider an inſect through the wonderful progreſs of its life, how different is the firſt period of its being from the ſecond, and both from the parent inſect: its changes are an inexplicable enigma to us: we ſee a green Caterpillar furniſhed with ſixteen feet, creeping, hairy, and feeding upon the leaves of a plant; this is changed into a chryſalis, ſmooth, of a

* In. Suec. 349.

golden luſtre, hanging ſuſpended to a fixt point, without feet, and ſubſiſting without food: this inſect again undergoes another transformation, acquires wings and ſix feet, and becomes a variegated white Butterfly, living by ſuction upon the honey of plants. What has Nature produced more worthy of our admiration? Such an animal coming upon the ſtage of the world, and playing its part there under ſo many different maſks! yet the ſame thing happens when a chicken comes out of the egg, except that the three different integuments are broken and fall off at once; for in the egg of a Papilio, the Epidermis or external integument falling off, a Caterpillar is diſcloſed; the ſecond Epidermis drying and being detached, it is a Chryſalis, and the third a Butterfly.

Among inſects how many centuries of tribes and genera are there, whoſe ſingular phyſiology, anatomy, and mode of living

living is not leſs admirable than that of the greateſt animals? when will the period arrive that all theſe wonders will be laid open to us? we contemplate with admiration the penetrating eye of the Lynx and the Serpent, and that of the Owl by which it diſcerns objects in the darkeſt night; but few people think that the eight eyes of the Spider merit their attention, or thoſe of the Tabanus* and Dragon fly, which conſiſt of an aggregate of innumerable ſmaller ones. We can hardly be ſatisfied with the pleaſure of viewing the beautiful branching horns of the Stag; the poliſhed, branching, hollow, coral-formed horns of the Stag-beetle, which he either puſhes out or draws back with an art unknown to the Stag, do not attract our notice: we pay no regard to the lamellæ of the horns of the Scarabæus fullonis, which open and ſhut like the leaves of a book: we look with admiration at the annulated horns of the Gazella†, the length of thoſe

* Horſe fly. † Antelope.

thoſe of the Goat, but paſs by with neglect thoſe of the Cerambix ædilis, which are much longer than his whole body, or the articulated horns of the Meloe*.——How few perſons are acquainted with the ſpecies of inſect named Monoculus†? the conſtruction of whoſe horns far ſurpaſſes that of all others; they are branched like the fingers of a hand, and expanded like arms, and by their aſſiſtance that animal performs its motions in the water.

We are ſtruck with the proboſcis of the Elephant, but are totally inattentive to the long beak of the Curculio‡, which is as hard as horn, and is furniſhed with a ſmall mouth at the extremity: Thoſe who have travelled to the Eaſt Indies talk of the Ant-eater who has no teeth, but devours ants by the aſſiſtance of his tongue, but we know that the tongue of the Papilio is rolled up in the form of a ſpiral,

* B. 112. † B. 186.

‡ Weevil. B. 98.

ſpiral, and that of the Culex* pricks like a needle and ſucks like a pump.

We are ſtruck with horror at the opening jaws of the Lion or Shark, but never caſt our eyes upon the numerous mandibles of the Dragon fly, which are naked without any covering of fleſh; theſe are far more deſtructive among inſects than Lions in their deſerts, or Sharks in the ocean: this ferocious animal ſeizes every inſect which paſſes by it, and breaks its legs at the firſt bite. We admire the ſwiftneſs of the Hare and Squirrel, but diſdain to conſider the elaſtic leaps of the Flea, or the ſprings of the Gryllus† in the form of a croſs, the dancing of the Cimex lacuſtris‡ upon the waters, the light intricate circumvolutions of the Dytiſcus natator§, the ſpring of the Elater‖ as he lies upon his

* Gnat, B. 177.
† Cricket, B. 144.
‡ B. 123. 24.
§ B. 108.
‖ B. 105.

his back, the dance of the Hemerobius*, the horizontal darting of the Aranea ſcenica† from a wall when he attacks a fly, or his horizontal return to eſcape the danger of a fall, when he is loaded with his prey.

See the large elegant painted wings of of the Butterfly, and four in number, covered with ſmall imbricated ſcales: with theſe he ſuſtains himſelf in the air the whole day, rivalling the flight of birds, and the brilliancy of the Peacock. There are alſo ſome things obſervable in the wings of inſects not found in birds; the different ſounds ſome ſpecies by their aſſiſtance make in their flight, their vertical poſition as in the Papilio‡, horizontal as the Tipula§, hanging down as the Phalæna‖.-----What bird has his wings protected with ſheaths ſo elegant as the Cantharis,

* Golden eye.
† Spider, B. 10.
‡ Butterfly.
‡ Berk. 171.
‖ Moths.

tharis*, or complicates them in ſuch regular forms as the Forficula†.

The Oeconomy of Bees is a ſubject of great curioſity: one female bee which is called the Queen has a train of lovers, drones, whom ſhe keeps in ſubjection: this perhaps is a ſingular inſtance in nature of the ſubjection of the male to the female. They have thouſands of attendants deprived of the power of multiplying their ſpecies, who wait upon them as ſervants; their combs are conſtructed and divided with ſo much accuracy, that the moſt expert Geometrician could not improve upon their diſpoſition.-----The common waſp covers her neſt with a great many teguments like bladders, one within another, leaving a ſtrait entrance at the bottom which admits but one at a time; and this is always guarded to prevent an enemy's getting in.

The labourof the Ants is alſo a ſubject well worth our curioſity: the males and

* Berk. 104. † Ear-wig.

females releaſed from all the common care ſwarm round their little city, wherever inclination invites them: the reſt are apparently in a ſtate of ſervitude to them; working the whole day, bringing home timber and materials, to finiſh their building againſt Winter, or carrying out their young to the warm ſun. In the mean while pleaſure and its ſeaſon is paſſed away; and the purpoſe of their nuptials being obtained, the neutrals expell the parent inſects from their habitations, which they occupy ſolely, untill the return of the Spring.

The Aphides, which live on the under ſides of the leaves of trees, furniſh a very ſingular phenomenon. By one congreſs of the male with the female ſhe not only becomes impregnated, but her future female deſcendants for five ſucceſſive generations, without the co-operation of any other male Aphis. Theſe animalcules deſtroy the fundamental phyſical

ſical diviſion of animals into oviparous, and viviparous.

The different neſts of inſects furniſh another curious object of obſervation. Some depoſit their eggs in the leaves of oaks to prevent them from periſhing, which thereby produces the red gall: Some in thoſe of the poplar which ſwell into a red node or bladder; to a ſimilar cauſe we owe the roſe upon the willow, the Bedeguar upon the roſe, the three pointed protuberance upon the termination of the juniper branches, reſembling the ſeed veſſel of the Arrow graſs; and by the eggs of others being lodged in the leaves of the Veronica* and ceraſtium†, they are drawn into a globular head; ſilicular pods upon the Maſtic and Piſtacia trees, and an excreſcence upon the Hieracium, reſembling a ſmall mouſe, are derived from the ſame cauſe: and laſtly theſe eggs

* Speedwell. † Mouſe-ear chick weed.

are depoſited in the back of the cabbage caterpillar, which after their transformation become Ichneumones.

In the Lapland Alps there is a fly covered with a downy hair called the Rhendeer gad-fly; it hovers all day over theſe animals; their legs tremble under them, they prick up their ears, and flee to the mountains covered with ſnow and ice; with ſo much terror do they avoid a minute fly hovering in the air; this inſect endeavours to lodge its eggs upon the back of a deer, which being effected the worm perforates the ſkin, remains under it the whole Winter, and in the following year becomes a fly. The common gad-fly is an equal terror to oxen.

Almoſt all Quadrupedes are infeſted with their own peculiar ſpecies of Lice, the Birds have theirs, and even Fiſhes do not eſcape. They have all their different ſpecific figures, a great number of which have

have been delineated by Rhedi, in an expreſs treatiſe upon this ſubject.

Trees likewiſe are annoyed by their own particular ſpecies of lice, the Aphides:--- the Alder is often covered with a white pubeſcence or down; upon a cloſer inſpection it appears to proceed from myriads of thoſe inſects called the Chermes alni; which being furniſhed with large pubeſcent tails, conceal themſelves with them leſt they ſhould become a prey to the birds. When I was in England I obtained many ſcarce American trees, and in my voyage to Holland I obſerved upon one of them an inſect of this kind which I had never before ſeen;----I preſerved it with the greateſt attention from cold and rain, and carried it to the gardens of Mr. Cliffort: but in a few weeks the ſpecies multiplied with ſuch rapidity, that it not only filled the green-houſe, but the Botanical Gardens of Amſterdam and Leyden, by means of ſome exchanged trees.

The

The Termes pulſatorius* reſides in books and wood, it enters holes bored by worms, and makes a noiſe like the beating of a watch: the ignorant vulgar have made it an object of ſuperſtitious terror ----the water alſo is ſubject to lice, the Monoculus pulex† frequently multiply in that element ſo as to cauſe it to appear of a uniform red colour.

The Spider carries its bag of eggs upon its back, from whence they are excluded; the Surinam Frog is of the ſame nature.

The Mole cricket, by the wonderful form and ſize of his claws which reſemble hands, burrows in the earth quicker than the mole or rabbit.

The Gnat, the Ephemera, the Phryganea‡, and the Dragon fly hover over the

* Death-watch, B. 181.
† B. 182, Greeniſh red Monoc.
‡ B. 159.

the waters all day to drop their eggs, which are hatched and continue there while in the ſtate of worms; but after they have acquired wings, if they fall in, they are drowned. The Muſca pendula ſeeks for troubled waters, its Caterpillar hangs down to the ſuperficies of the water by its elongated tail of a ſpiral form, by the help of which it lets itſelf down and riſes again though it be to all appearance a very weak animal, hardly any force is able to cruſh it to death.

The Deſmeſtes pertinax draws in its head and feet if you barely ſtretch out a finger at it; it bears the utmoſt torments rather than move a ſingle joint.

The Muſca vomitoria* lays innumerable eggs; ſome people to this day are ſo ignorant, as to ſuppoſe that the Aſcarides in the human body owe their origin to theſe eggs conveyed into the ſtomach, but

* Blue Fleſh fly, B. 75. 13.

but contrary to every appearance of reaſon: For the Aſcarides cannot be propagated in the human body without ſwallowing freſh eggs, as inſects never propagate until they have gone through all their transformations; but flies cannot be ſuppoſed to copulate and lay eggs in the inteſtines. The Aſcarides are of a different claſs of animals.

The Muſca putris* hover in innumerable myriads over ſtagnant putrid waters, or thoſe draining from a dunghill; they get into the cracks of cheeſe and lay their eggs, the worms bred from them are vulgarly aſcribed to an equivocal generation, contrary to an eſtabliſhed law of Nature.

What numerous eggs does the Crab produce, one of the largeſt inſects even if we admit the lobſter as one.-----In a few

* B. 76. 17.

a few days it depoſits them all*, and they hang under its foliaceous tail. There are ſome other very ſingular particulars relating to the generation of this inſect* and the Libellula*.

The crab named the Hermit ſearches for deſerted ſhells and conchs, in which he inhabits leſt his naked tail ſhould be hurt by external violence, which he is no leſs ſolicitous to protect than the bear: thus he rolls about in the ſhell of another fiſh, like the Cynic in his tub---We muſt view with admiration the lungs of the Crab concealed under his large breaſt plate, the mouth in the naked breaſt near the ventricle, his eyes of a hard ſubſtance, his ſtrange motion, his gigantic claws, the annual renewal of his ſhell, and the recovery of the larger and ſmaller claws if he loſes them :----but we ſhall be wrong if from this we conclude that that firſt

* See Note (*A*) at the end of this Eſſay.
Notes (*B*) (*C*) two paſſages omitted.

axiom of Natural Science " all living things are generated from an egg" is falſe, although the Polype and Gordius* cut into a hundred parts revive in ſo many diſtinct animals: the analogy between theſe reproductions and the roots of vegetables clears away the difficulty.

Let us conſider the ſhort life of the Ephemera:----it ſubſiſts a long while in its vermicular form in the waters, but as ſoon as it becomes a winged animal it lives only twenty-four hours, which are ſufficient to multiply its ſpecies.

The Phryganea† next preſents itſelf to us, which inhabiting the waters among its voracious enemies the fiſh, covers itſelf over with little ſtraws, ſand, and fragments of leaves that it may lay concealed: if you ſee it under water you would be induced to think it a ſmall putrefying piece of the twig of a tree, not a future fly.

The

* B. 195. † B. 159.

The Caſſida merdigera, and the Chryſomela*, with compreſſed neck cover themſelves entirely with dung that they may not be diſcovered by birds, the Graſshopper called the Cuckow ſpittle conceals itſelf with its own froth: who does not laugh at the odd appearance of the Cimex perſonata† which covers itſelf over with all kinds of rubbiſh, and to conceal itſelf the better diſguiſes its ſtep; and though a beautiful inſect, exerts all its little ability to reſemble the moſt deformed of ſpiders.

The Phalæna ſarcitella‡ is likewiſe very curious, which deſtroys our curtains, cloathing itſelf and feeding upon the fineſt threads of the wool: but while it is employed in building its houſe, it grows larger and becomes too big for it, by which it is obliged to cut it in pieces and make additions to it; it has hardly

* B. 94.
† B. 156. 79.
‡ B. 121. 19.

finiſhed this alteration but a ſecond becomes neceſſary: thus its labour is continually increaſing upon it, if you fix it ſucceſſively upon different coloured cloths, it is transformed into a party-coloured harlequin.

There are many Curculiones* which depoſit their eggs under the cutaneous bark of the Chenopodium†, which transformed into worms make their way between the upper and lower membrane of the leaf: theſe burrow in vegetables like moles in the earth, leſt they ſhould be expoſed to injuries from the air, or be the prey of birds. The ſame thing is obſerved in the Indian creeping leaf; the ancients were perſuaded that ſome trees in India bear leaves which had the locomotive power of animals. The caſe is this: thoſe worms called the Foliaceous cicada and Gryllus ficcifolius‡ included in

* B. 97.

† Blite, &c.

‡ Cricket and Graſshopper.

in the leaves, put out their feet from certain perforations, and under this cover move from place to place with ſecurity, with their houſes upon their back.

The Coccus*, who lives upon trees, ſurpaſſes in ingenuity the Oniſcum ceti; a large Caterpillar gives birth to a very minute inſect, wonderful in its form and nature. The Lion-piſmire, a native of the ſands, lives without water, and content with a very little food it buries itſelf in the earth for fear of birds, and reſides in the center of its little pit which it forms in dry moveable ſand like an inverted cone; the ants paſſing by fall into it, and become the prey of the animal which lies at the bottom in ambuſcade.——The Meloe† exſudes an oily moiſture from all its limbs when touched:-----The female Glow worm emits a ſhining light in Summer evenings in thickets, a ſignal to the male. I ſhall not

* B. 127. † B. 112.

not have recourſe to the foreign inſtances of the Cicada* of Surinam, which carries a large lantern before its eyes; nor the Scolopendra† which emits ſparks like the back of a cat when rubbed in the dark.

In the modes of continuing the different ſpecies there are ſome wonderful ſingularities; among the Bees, the Ants, and the Oniſci, there are many neutrals, and but few males and females. By what reaſon was Nature induced to give wings to the male glow worm and ſome of the Papilios, and refuſe them to the female? when it appears that a contrary order would have been more favourable to their multiplication.

The Crab, the Scorpion, and the Nepa‡ are armed with very formidable claws; the ſtings of the Scorpion, the Bee, the Waſp, the teeth of the Dytiſcus, and Indian

* Graſshopper.
† Sc. Electrica, B. 188. 3.
‡ Water Scorpion.

Indian Scolopendra, and many Spiders contain the moſt noxious poiſons. How wonderful are the oars with which the Nepa, the Dytiſcus*, the Notonecta† row themſelves in the water? and that beautiful thread with which the Silk worm ſpins himſelf round? the ſubtle web of the Spider is a matter of the greateſt aſtoniſhment, and the central poſition ſhe occupies to obſerve the ſmalleſt fly move her fine net; ſhe darts croſs a room from wall to wall, walking neither on the floor or cieling; ſhe elevates herſelf in the air above the higheſt towers, and the reach of our ſight without the aſſiſtance of wings; thoſe fine ſtreaming threads (the Goſſamer) which in Spring cover the fields are her ſpinning: her thread is a combination of numerous filaments, and every filament twiſted with the moſt wonderful art: ſhe watches all day for her prey, but falls a prey herſelf if diſcovered to the voracious Ichneumon.

* Water beetle. † Boat fly.

Almoſt

Almoſt every plant has its inſect, every Caterpillar its plant, ſome indeed feed more indiſcriminately, but all the plants they feed upon ſeem to poſſeſs the ſame medical properties:---Perhaps we might learn from caterpillars ſome uſeful leſſons upon the virtues of plants in medicine.

The man who ſhould free Apulia from the Tarantula, India from Scorpions, Norway from Gnats, Lapland from the Gad fly, cottages from the Cricket, Finland from the Blatta*, Paris from Bugs, children from lice, horſes from the Tabani†, gardens from the Aphides, fruit trees from the Caterpillar, or clothes from the Moth, would deſerve every gratuity and honour.

The nature of the Oriental Blatta is now diſcovered: this tribe living upon plunder was poſſibly firſt introduced from America or Surinam, where they are called Kakerlacki; and paſſing over into Europe

* B. 114. † Horſe fly, B. 177.

Europe increaſed there greatly, they ſpread over the Turkiſh empire, Ruſſia, Finland, and are now ſaid to lurk in Stockholm: this black band of robbers commit their depredations in the night, devouring our ſhoes, clothes, and meat, but particularly loaves of bread, which they hollow out intirely leaving only the exterior cruſt.----Who would be induced to believe that the Caterpillar which produces the Muſca cameleon* is more tenacious of life than an ox.

When Malpighi diſſects the Silk worm before your eyes, you ſee the wonders of Nature diſplayed in it:----Yet there are wonders which ſtill ſurpaſs it; Swammerdam anatomiſes a louſe, and we are every one obliged to own that the ſun does not behold a more accurate piece of animal mechaniſm in this world of beauty.----Read Reamur upon the Larva proceſſionaria, and on the ſingular modes of life of ſome other inſects;-----turn

* B. 173. 1.

over Friſchius with attention, and join to theſe the catalogue of inſects which I had collected in ſixteen years in Sweden, and firſt publiſhed in the Fauna ſuecica.

Here is a large field open to thoſe who are curious to purſue original paths in ſcience: a ſcience left in darkneſs or illuſtrated with but a faint light by our predeceſſors.----He who ſhall take delight in cultivating it, and bring diligence and ingenuity along with him to the purſuit, may have his labours rewarded by the diſcovery of a more elegant ſweet than honey, a more tenacious thread than that of the Silk worm, a more glowing crimſon than that of the Coccioneal: but he will ſtand in need of patience, the eaſy mind and opportunities of affluence, and much and repeated obſervation.

Theſe are the armies of the Moſt High to puniſh diſobedient nations; every band has its orders to fulfil, in the diſtribution of

of reward or puniſhment.---If He decrees to chaſtize mankind, a ſingle ſpecies of theſe animals are multiplied as the ſand of the ſea and perform their Divine commiſſion:——The graſs of the field is to be cut off, many legions of the Phalæna graminis* are at hand——the Garden Tipula devours the green herb, the Curculio granarius† deſtroys corn; our eſculent vegetables become a prey to the Mordella oleracea‡, the Cryſomela, and the Cabbage butterfly. One ſpecies of Moth deſtroys the root of the Hop, the Melolontha§ the leaves of trees, the Phalæna pomonella‖ the bloſſoms of fruit, the Dermeſtes lardarius¶ fleſh, the Silpha rugoſa dried fiſh, the Acarus ſiro cheeſe and meal, the Phalæna tapetzella** our clothes, the Dermeſtis pertinax wood, and the Cantharis navalis the ribs of

 ſhips.

* B. 171. 4.
† Weevil, B. 98. 7.
‡ Ch. oleracea, B. 96. 11.
§ Tree beetle, B. 87. 10.
‖ Codling moth, B. 156. 81.
¶ B. 88. 1.
** B. 155. 78.

ſhips. But who can enumerate their multiplied tribes? the Supreme Diſpoſer of all Things gives his command to thoſe minute Animalcules the Sirones, and the whole man becomes one loathſome contagion: not to mention thoſe miniſters of diſeaſe and death who bring down upon us the plague, ſmall pox, ſpotted fever, and other infectious and ſpreading diſorders. —— Our time is elapſed we muſt come to a concluſion,

Theſe are the effects of the Divine Power and Wiſdom to which we have conſecrated our vacant hours; to theſe ſtudies we ought to dedicate that time which we too frequently waſte in frivoliſm, gaming, or other exceſſes: let us ceaſe to complain of the brevity of human life, we ſhorten it ourſelves.

The treaſures and miracles of nature are ſcattered with profuſion on every ſide of us. The knowledge of theſe conſti-

tutes

tutes true wiſdom, and carries home our thoughts to our Creator, to ourſelves, and the neceſſities of our natures: we are not all born to the ſame abilities or occaſions of illuſtrating this uſeful Philoſophy; and many ſingular diſcoveries we are daily making, of the uſe and application of which we are yet ignorant; as we plant trees of which our remote poſterity muſt gather the fruit. Who would have believed, when Camerarius was purſuing his experiments upon the propagation of plants, that he was laying the foundation of a future ſcientific Botany.

Now after a long peace, and innumerable inſtitutions to promote the felicity of our country, Sweden contends for the firſt rank in ſcience and erudition with the moſt literary nations in Europe. I congratulate myſelf upon the happineſs of living in an æra where I ſee the genius of my country trying her native ſtrength,

ſtrength, and the foundations of an academy ſo calculated to promote her eſſential intereſt. The names of my illuſtrious Auditory who have undertaken ſo great a work ſhall be conſecrated to immortality; thoſe liberal patriot citizens, who have devoted their genius, their labour and repoſe, to the republic and poſterity.

And let me acknowledge the honour you have done me by electing me your firſt Preſident, as the greateſt I have ever received. I return you my ſincereſt thanks for that attention with which I have been this day heard, for your advice and aſſiſtance, that worthy zeal and conſtant attendance with which you have protected this riſing ſociety, and that candour with which you have paſſed over my want of experience in ſome departments of the buſineſs of the Academy: for theſe give me leave to repeat the ſincereſt thanks that a ſentiment which I had almoſt called

called the piety of gratitude can return.

(*A*) Dr. Baſter numbered the eggs produced by the Aſtucus gumarus and found it produced 12. 444.---- Pennant.

(*B*) *Mas duabus cupidinis telis inſtruitur, quod nulli quadrupedi, avi, aut piſci conceſſum.*

(*C*) *Libellula. Mas amore æſtuans huc illucq. volat, jactatque caudam bifurcam forficis in modum diductam: vidit feminam & extemplo cauda ſua ejus collum prehendit, coacta raptorem ſequitur, atque ut dejiciat violentum procum reflectit caudam ad maris pectus, qua quidem parte natura recondidit telu et arcus amoris.*

DISSERTATION VIII.

THE FLORA OF INSECTS,

BY

JONAS GUSTAVUS FORSSAHL.

Am. Acad. v. 3. p. 271.

SUMMARY.

Introduction——The progreſs of inveſtigation from generals to particulars——Inſects but lately attended to——ſtate of this ſcience among the ancients——Critical account of modern authors upon this ſubject——firſt obſerved by Mouffet

 ——draw-

——drawings of them by flower painters——and the invention of Microſcopes aſſiſt the ſtudy——Swammerdam——Reaumur——Linnæus——Many inſects confined to plants of the ſame qualities——more to thoſe of the ſame genus——ſtill more to the ſame ſpecies——and ſome to a ſingle part of its ſpecific plant——plan of an arrangement of inſects from the plants they feed upon——its uſes——to direct the reſearches of the Naturaliſt——to diſcover plants of ſimilar qualities——uſes to the gardener——the farmer——the breeder of inſects, as Bees, Silk worms——General corollary plants leaſt eaten, or moſt protected from beaſts, eaten by moſt ſpecies of inſects.

THE Geographer deſcribing the habitable earth, firſt begins by tracing out the boundaries of the greater kingdoms, ſo that their limits and poſition may be comprehended at a ſingle view;

view: then marking out their provinces, cities and towns, he introduces us to a full knowledge and detail of the ſubject. He who is acquainted only with the principal diviſions of the globe, muſt be admitted to have but a very ſuperficial knowledge in this ſcience; it is the ſame in Natural Hiſtory, it is not ſufficient to have a confuſed idea of the three great kingdoms of Nature; to cultivate it properly we muſt not only be acquainted with the ſcientific diviſion into claſſes, orders, and genera; we muſt endeavour alſo to acquire the completeſt knowledge of the nature and properties of the ſpecies, and the varieties ranked under them.

Of all theſe enquires that into the nature of Inſects has been the laſt undertaken, it is but very lately that our attention has been directed to theſe animacules.

Among the ancients, Ariſtotle and Pliny have left us ſome few obſervations upon them. Their other writers have almoſt totally neglected them. At the revival of literature, this ſcience was long paſſed over either with ſilence or contempt. Conrad Geſner, the moſt diligent enquirer into Nature of his age, who may be ſaid to have rekindled the torch of natural ſcience, could not extend his reſearches into every minute branch of it. His diſciple, John Bauhin, gave himſelf up totally and excluſively to Botany, following the example of Columna.

Mouffet, an Engliſhman, was one of the firſt who turned his thoughts to a ſubject which the prejudices of his age looked upon as of very little moment.

Aldrovandus, who was an indefatigable compiler, and celebrated for the multitude of his works, applied his induſtry to this ſubject, but thought he had acquitted himſelf of his office, in ſcraping

ing

ing together the indigeſted obſervations of antiquity.

Jonſton ſucceeded him, a plagiariſt equally perſevering, without adding a ſingle original remark to what had been before diſcovered.

The knowledge of inſects remained thus diſeſteemed and uncultivated until the middle of the laſt century: when ſome painters who employed themſelves in copying beautiful and ſcarce plants, obſerving the different kinds of inſects which they nouriſhed, ornamented their deſigns with drawings of them, and of ſeveral very beautiful butterflies.-----As they were thus employed, new and capital diſcoveries were made every day; till at laſt they began to apply themſelves to this ſubject with great ardor as a ſtudy, among theſe we reckon the names of Robert*, Hoefnagel, Geodart,

* See Note *(A)* at the end of this Eſſay.

dart, Merian, Schvartz, Albin, and Roeſel.

The invention of Microſcopes opened to the curious a nearer way to penetrate the myſteries of Nature, and enabled them to diſcover many things totally unknown to antiquity. The facility attending theſe diſcoveries induced many to cultivate a ſpecies of ſtudy, that had been before erroneouſly regarded rather as the gratification of a trifling and minute curioſity, than as matter of uſe: among theſe were Hooke, Lewenhoek, Joblot, Needham, and many others.

But none of them equalled the induſtry of Swammerdam; who not only deſcribed the external appearance of Inſects, but by his anatomical reſearches diſcovered their internal ſtructure.——This laborious application opened new ſources of knowledge to him, which joined with his perſpicuity made him univerſally admired. At the concluſion of the laſt

and

and the beginning of the preſent century, all parts of Natural Hiſtory were purſued by men of the greateſt ability; and this ſeems in a particular manner to have attracted their attention.

Liſter, an ornament to his age and nation, deſcribed the Engliſh ſpiders in ſo clear a manner, that to this day his work has not been equalled.

Ray, a man of inexhauſtible induſtry and labour, after he had compiled a Hiſtory of the Plants known in his time, dedicated the reſt of his life to the Natural Hiſtory of Inſects; and has left very copious obſervations upon the ſubject.

Friſchius obſerved the metamorphoſis, nature, and manner of living of all the Inſects in Pruſſia, and publiſhed ſeveral very excellent obſervations upon them; but this ſcience had not yet received its total ſplendor:

Reaumur

Reaumur, one of the moſt attentive enquirers into Nature, was reſerved for this purſe. He watched Inſects continually from their births to their deaths, and laid open their firſt periods of life, their nuptials, manners, covering, habitation, and mode of living: he examined them anatomically, and in our old world laid open a new one. Since his diſcoveries, none but the enemies of natural ſcience will pronounce that this ſubject has more curioſity than utility in it.

But upon this occaſion I muſt be forgetful of myſelf, and a ſtranger to the duties of a mind replete with gratitude, if I paſs over the name of that man whoſe patronage (by the recommendation of our Preſident) has for many years aſſiſted my ſtudies and my fortunes. I ſpeak of our countryman the illuſtrious Charles de Geer: of whoſe virtues or whoſe uncommon knowledge in this department of Natural Hiſtory we are at a

loſs

loſs which moſt to reſpect. In the affluence of fortune he has given himſelf up to the ingenuous purſuits of Philoſophy, adding to the diſcoveries of Lewenhoek by the aſſiſtance of the beſt microſcopes, extending the anatomical reſearches of Swammerdam, joining to theſe all the objects of inveſtigation propoſed by Reaumur, and finally digeſting the catalogue of inſects into claſſes and orders. The Republic of Letters has lately had a proof of his diligence and ability in the firſt volume of Memoires pour ſervir a l'Hiſtoire des Inſectes, printed at Stockholm in 1752, and expects with impatience the continuation of this work.

The labours of our illuſtrious Preſident in the arrangement of the natural kingdoms are too well known to be here enumerated. After he had ſettled its other branches with his uſual diligence and perſpicuity, he reduced the diſperſed Genera and families of Inſects into order: this arrangement was firſt publiſhed

in the Syſtema Naturæ in the year 1735, and afterwards in 1740. To facilitate the progreſs of his pupils in this ſtudy, he has ſeparately deſcribed the Swediſh Inſects, given characters and differential marks to the Genera, and defined the ſpecies in his Fauna Suecica: and likewiſe joined to it a liſt of the Synonyms uſed by different authors, an addition of great utility. To this work we owe that our Univerſity has more ſtudents in this branch of Natural Hiſtory than all the world beſide; by theſe ſteps the knowledge of inſects has attained to its preſent eminence in Europe, enriched with the collections of Pettiver, Sloane, Cateſby, Ehret, Merian, Vincent, and the Author of the Muſæum Petropolitanum, which abound with the productions of every country in the known world. And this ſcience will receive additional lights, when the magnificent collection of our Sovereign Louiſa Ulrica, containing an infinite number of inſects from India,

ſhall

ſhall be publiſhed for the benefit of the Philoſophical World.

As Nature propoſed to herſelf certain ends in the formation of every animal, ſo ſhe has in that of Inſects; that they may preſerve a proper equilibrium among many things.——Some have one kind of plant marked out for them to inhabit and feed upon, others another aſſigned them as if by lot. Every animal by a law of nature nouriſhes and harbours its ſpecific inſect; the food of ſome of this tribe is putrid ſubſtance, others prey upon thoſe of a different ſpecies, and even upon their own, and harraſs each other with perpetual carnage.

But as the length of an Academical Eſſay confines me to ſuch reſtrained bounds, I ſhall content myſelf with giving an account of thoſe inſects which inhabit our Swediſh plants, and devour

their roots, ſtems, leaves, flowers, or fruits. Of theſe phytivorous animals many prey indifferently upon ſeveral ſpecies; but we ſhall not always be ſo minute as to mark them all out; as it is certain that far the greater attach themſelves to a ſingle plant, and many even to one particular part of a plant.——There are not a few who range over the different ſpecies of the ſame genus, or different genera, which are related by their nature and properties.

That I may proceed with regularity in numbering up the plants which are the food of certain inſects, I ſhall adhere to the order they are placed in the Swediſh Flora as a ſtandard. I muſt not deny that there are many vegetables whoſe inhabitants I have not yet been able to diſcover; but I am ſo far from pronouncing that they have none, that I recommend them to the more ſtudious attention of others; to complete ſo uſeful an inveſtigation, the induſtry of many obſervers muſt

muſt be exerted in very diſtant places. As to the catalogue of inſects, I ſhall follow the Swediſh Fauna as a guide; that their genera and differences may be clear to every one, together with their ſynonyms and deſcriptions.

I hope the public may derive ſome benefit from theſe obſervations upon the following accounts.

1. The Entomologiſt will be able to find a given ſpecies with more eaſe by knowing the plant it lives upon.

2. When he happens with an inſect whoſe metamorphoſis and nature he wants to ſtudy, he will be able with more facility to rear it.

3. They often produce inconveniences to the Botaniſt. I remember a few years ago we received a number of ſeeds from Virginia; among the plants raiſed from them there was one which we were unable

ble to determine any thing about, becauſe it had not yet produced a flower: but the Caterpillar of the Tenthredo ſcrophulariæ*, and the Curculio ſcrophulariæ†, ſeizing upon its leaves, our Preſident declared that there was very little doubt of its being a ſpecies of that plant: in effect it proved to be the Scrophularia marilandica‡.

4. Our Phyſicians may form a judgement of the quality of herbs from the inſects which prey upon them, as they generally ſelect thoſe whoſe virtues are ſimilar: this was an opinion advanced by Mr. Derham ſome years ago. Thus the Caſſida viridis§ eats the Lycopus‖ and the Mint; the Papilio machaon¶ feeds upon all the umbelliferous plants which very nearly approach each other in their medical

* B. 163. 4.
† B. 100. 22.
‡ Maryland fig-wort.
§ Green tortoiſe beetle, B. 92. 1.
‖ Water horehound.
¶ Swallow tail, B. 129. 1.

cal properties; and the Papilio cardamines* devours the Cardamine pratenſis†, and the Thlaſti campeſtre‡; both of the claſs tetradynamia.

5. Gardeners will be inſtructed to protect the plants which they cultivate from the inſects moſt noxious to them. As for example the roots of the Lettuce, the leaves of the Cabbage, the heads of Aſparagus, and the flowers and fruits of trees.

6. Farmers and cultivators of any particular plants, graſſes, or corn, ought to be well acquainted with the ſpecies of inſects moſt hurtful to them; as to the roots of hops, the buds of tobacco, the ſeed corn of barley, the ſtalk of rye, wheat when in the ear; and the ſeed, root and leaves of all crops. And as almoſt every plant is made of ſome ſervice in our

* Orange-tip butterfly, B. 130. 7.

† Lady's ſmock.

‡ Mithridate muſtard.

our domeſtic œconomy, it is highly deſerving our conſideration to know what they ſuffer from inſects.

7. In our œconomics it is likewiſe of uſe to know what is the proper food of thoſe inſects we rear for profit. If our object be the Silk worm we muſt procure them Mulberry leaves, if the Cóccioneal the Indian fig, if the Coccus polonicus the Scleranthus* or Piloſella†, if the different ſpecies of the Chermes tinctoria, the Betula‡ and Carpinus§:---But where our attention is directed to raiſing Bees, and producing honey,

Hic circum Caſſiæ virides et olentia late
Serpilla, et graviter ſpirantis copia Thymbræ
Floreat, irriguumque bibant violaria fontem.
VIR. GEOR.

There let the Thyme far-breathing fragrance ſpread,
The Thymbra rear its aromatic head;
There let the Caſſia's ſhining verdure beam,
And violets drink new odours from the ſtream.

8. Thoſe

* German knot-graſs.
† Hawk weed.
‡ Birch.
§ Horn beam.

8. Thoſe who are lucurious in inveſtigating the œconomy of nature may obſerve by the annexed liſts, that thoſe plants which the Creator has guarded moſt againſt the ravages of other animals, leſt they ſhould be totally uſeleſs to the citizens of the univerſal republic of living beings, maintain a great number of inſects, and conſequently birds: thus we ſee the loftieſt trees which by their height eſcape the ravage of Quadrupedes, feed the greateſt number of ſpecies.

It is the ſame with the thorny plants*, which by their ſtructure they cannot prey upon.

We may extend this obſervation to thoſe natural claſſes of plants of which the ſpecies are moſt numerous, as the Graſſes. And alſo to thoſe refuſed by cattle* in general.

* See Note *(B)* at the end of this Eſſay.

We may likewiſe obſerve how the providence of the great Creator has taken care that as ſoon as any ſpecies of herb by its ſtrength and multiplication gets ſuch force as to exclude others, whole armies of inſects attack it to reſtore its numbers to a due limit: for a natural inſtinct determines them to ſeek out ſuch places, where they increaſe with the greateſt rapidity from the plenty and facility with which they get their food.

(A) The Hiſtory of the Drawings of Robert and Hoefnagel is given by Monſ. de Juſſieu, in the Memoirs of the Academy of Paris for the year 1727: it demonſtrates that Botany lays under ſimilar and even greater obligations to painting than the ſtudy of inſects. Tournefort founded his ſyſtem upon the drawings of Robert, and his ſucceſſor the St. Aubriet. As this Memoir is very curious and entertaining, I have here connected the moſt intereſting parts of it together.

The Hiſtory of a Collection of Drawings of Plants in the Royal Library at Paris, by Monſ. Juſſieu, from the Memoirs of the Academy of Sciences, anno 1727.

The Arts and Sciences frequently owe their perfection to circumſtances which may appear the effects of mere chance:

chance: the merit a work which the art of embroidery gave birth to, and from which Botany may reap the greateſt advantage, is a ſtriking proof of this.

Embroidery was very much in faſhion in the reigns of Henry the Fourth, and Lewis the Thirteenth, for magnificent and elegant furniture, as well as habits. As it copied natural flowers in their proper colours, it neceſſarily occaſioned flower painting to be much cultivated. No period ever abounded with ſo many collections of engravings of flowers, the works of Hoefnagel, Sweertz, de Bry, Vallet, and many others, were publiſhed at this time.

This elegant ſpecies of luxury became ſo prevalent, that our common flowers beginning to be overlooked, foreign plants were ſought after and cultivated with great attention, to furniſh new ſubjects to the embroiderer; an obligation which Botany lies under to the cares of the toillete.

Jean Robin was the firſt who diſtinguiſhed himſelf at Paris by the culture of theſe exotics; but his garden became afterwards in ſome meaſure that of Henry the Fourth, and Lewis Thirteenth, when he received the appointments and title of Royal Botaniſt: There Pierre Vallet, their embroiderer, copied from Nature thoſe flowers he introduced in his works. He has publiſhed his deſigns in a folio volume of engravings, and added printed directions for colouring them; aſſiſted by which many illuminators have laboured with great aſſiduity, to disfigure the plates of Brunsfellius, Matthiolus, and

the old Botaniſts. The ſon of Robin being aſſociated with his father, in the year 1624 publiſhed a Latin catalogue of 1800 plants cultivated in this garden.

But the eſtabliſhment of a Royal Phyſic Garden two years afterward in the Fauxbourg St. Victoire, greatly encreaſed the number of plants in France; it was under the care of the phyſician Guy de la Broſſe.

After Vallet's collection mentioned above, Firen engaged Daniel Rabel to engrave the plants of the old garden; this publication came out in folio in 1632.

La Broſſe, to ſhew the ſuperiority of the Royal Garden, employed Abraham Boſſe to publiſh a folio volume of double the ſize of the former; to conſiſt of ſuch plants only, as were no where elſe to be found.

This was a great enterprize: we have ſtill fifty of the plates remaining, which preſerve to us ſome ſpecies of plants unknown to our preſent Botaniſts: theſe plates, one of his relations, Monſ. Fagon, ſome years ſince reſcued out of the hands of a brazier; to whom la Broſſe's deſcendants, ignorant of their value, had ſold them.----They were the ſole remains of near four hundred which were already finiſhed.

This curioſity was not confined to private men; Princes themſelves gave into it:----Gaſton of France, Duke of Orleans, formed a garden of rare plants at Luxembourg, and another at Blois, where he reſided a great part of the year. His attachment to this purſuit was ſo great, that he employed four celebrated Botaniſts to ſuperintend them; and a number of painters in miniature, to adorn his cabinet with drawings from them. Among theſe none equalled the pencil of Nicholas

cholas Robert, his pieces are each upon a ſheet of vellum of the folio ſize, and copied with ſuch preciſion that the leaſt part of every plant is perfectly expreſſed: to theſe he added ſuch birds, and other animals as the the Prince's menagerie furniſhed.

Upon the death of this Prince in 1760, Colbert thought this collection an acquiſition worthy of Lewis the Fourteenth: he likewiſe created the poſt of Cabinet Painter in favour of Robert, to engage him to perſevere in his plan: he continued to enjoy it twenty years, finiſhing every year twelve ſheets, for each of which he received a gratuity of one hundred livres.

This able painter, though he reſerved all the pieces in his beſt manner for his maſter, yet jealous of the limits that reſtriction oppoſed to his fame, he copied ſome of them in a manner which has diſperſed his reputation throughout all Europe; by etching with his own hand birds, crowns, vaſes, and knots of flowers of different ſizes for embroiderers. The title of this collection is, Icones variæ et multiformes Florum appreſſæ ad vitam.

When Monſ. Colbert ſet on foot his great deſign of employing the Academy upon a general hiſtory of plants and animals, his drawings of thoſe ſubjects were ſought for with great avidity; on account of that exactitude and correctneſs of deſign which was become familiar to him.

Thus an application and talents which on the part of Robert were dedicated to no other end than curioſity, embroidery, and manufactuers of wool and ſilk, became the foundation of a collection of Natural Hiſtory which is a unique in its kind.

After

After the death of Robert the Sieur Joubert obtained his appointment, and employed the Sieur Aubriet as his deputy.

Dr. Fagon, Profeſſor of Botany in the Royal Garden, endeavoured to inſpire him with that genius and taſte of Nature which had rendered Robert unequalled: he was greatly aſſiſted by the attention Monſ. Tournefort paid to make him copy the ſeveral parts of the plant detached and ſeparate; this he has done in a manner ſo exact, that his drawings afterwards ſerved that celebrated Botaniſt to eſtabliſh the ſyſtem by which he has divided plants into their claſſes and genera.

Aubriet greatly ſurpaſſed his predeceſſor Robert in the number of his works and the rapidity of his pencil: Robert painted only twelve, he finiſhed thirty of theſe drawings every year, and attended Monſ. Tournefort in his travels to the Levant.

Theſe drawings were all depoſited afterwards in the Royal Library, and the collection diſcontinued: the preſent Librarian has exerted all his intereſt to have it reſumed.

(B) The number of Inſects feeding upon each plant is placed againſt its name.

TREES.

Ulmus	*Elm*		15
Prunus, Ceraſus	*Cherry tree*		10
Prunus Padus	*Birds cherry*		27
Pyrus	*Pear*		32
Tilia	*Lime*		8
Almes	*Alder*		18
Betula	*Birch*		16
Quercus	*Oak*		42

Carpinus

TREES *continued.*

Carpinus	*Horn-beam*	4
Corylus	*Hazel*	9
Fagus	*Beech*	9
Pinus	*Pine*	19
Salix	*Willow*	51
Populus	*Poplar*	17
Fraxinus	*Aſh*	4

SPINOUS PLANTS.

Groſſularia	*Currants*	15
Roſa	*Briar*	13
Rubus	*Bramble*	10

PLANTS refuſed by CATTLE.

Rumex	*Dock*	10
Urtica	*Nettle*	17
Carduus	*Thiſtle*	10
Nymphæa	*Water-lilly*	3
Potamogeton	*Pond-weed*	2
Scrophularia	*Figwort*	5
Hyoſcyamus	*Hen-bane*	4

(*C*) A liſt of Inſects according to this plan, containing twenty-eight pages, concludes this Eſſay, but it is of too local a nature for tranſlation. A work of this kind, if judiciouſly executed for our own country, would make an excellent appendage to a Fauna Britannica.

The moſt commodious method of ſuch a catalogue to aſſiſt the Naturaliſt in forming his collection, would be to arrange the inſects by the months of their appearance in a given ſtate; as for inſtance the months in which the Pap. Machaon was to be found as a Caterpillar, a Chryſalis, or winged.

The

The ſubdiviſion of the liſts of every month ought to be by ſoils, the ſame as in the general Herbation of a kingdom; for the ſoil, &c. being given, the plants it produces are given: ſuch a liſt would be of the ſame utility to the Naturaliſt, that a kalendar is to the Farmer and Gardener; it would point out to him what he had to do, and where he was to ſearch every month to make up his collection. And upon a given time and place what he was to direct his ſearches after. When Mr. Hudſon's avocations give him leave to publiſh a Fauna Britannica, in the ſame excellent manner in which he has executed the Flora Anglica, a catalogue of this kind will be very eaſily extracted from it.

DISSER-

DISSERTATION IX.

ON

NOXIOUS INSECTS,

BY

MICHAEL A. BAECKNER.

Am. Acad. v. 3. p. 335.

SUMMARY.

Cauſe of our ignorance of the Natural Hiſtory of Inſects——1. *their minuteneſs*——2. *transformations*-----*curioſity of this ſtudy, facility*——*uſes hitherto detected*——*noxious qualities not conſidered*——*contempt of the ſubject ill founded*——*other branches of Oeconomics more cultivated*——*the Naturaliſt in fault*——*ſubject Noxious Inſects divided into claſſes.*

Glaſs	1	*Man.*
	2	*Victuals, clothes, furniture, buildings, &c.*
	3	*Fruit trees and kitchen garden*
	4	*Groves and ſhrubberies.*
	5	*Fields.*
	6	*Spontaneous plants.*
	7	*Foreſt trees.*
	8	*Cattle.*
	9	*Birds.*
	10	*Fiſh.*
	11	*Other inſects.*

Inſects noxious to

INSECTS are the moſt numerous tribe of animals though leaſt in ſize: they ſwarm every where and particularly in Summer, and no place is ſo barren but they are capable of finding food and ſuſtenance, even where every other living being periſhes with hunger. Few of them, eſpecially ſuch as live in dry places, ſurvive the year; but this ſeeming want of indulgence in Nature is abundantly compenſated by their rapid increaſe by propagation: they are multiplied in myriads in

a very ſhort time, ſo as to become thoſe innumerable armies by which the Divinity reſtrains or puniſhes the ſins of human kind.

Their minuteneſs which eludes the human ſight, and the multitude of their different genera, have been among the cauſes that have hindered our acquiring a full knowledge of them: but the principal reaſon has been, the different forms they put on in the different periods of their lives; for generally they aſſume three very diſtinct appearances, the two firſt are that of the Caterpillar and Chryſalis, from which the adult and perfect inſect, now ſtripped of the integuments under which it was before concealed, differs as much as light from darkneſs. In theſe animals we ſee Nature realize metamorphoſes more wonderful, than the rich and fanciful pencil of Ovid, the poet of fiction, ever painted.

Their

Their neſts, their lodgements for their young brood, their nuptials, and beautiful forms and colours, their little aſſociations, or more numerous republics emulouſly engaged in the common labour, are delightful objects of our attention and ſtudy. A thouſand occaſions (offering themſelves and not requiring to be ſought after with a laborious attention) continually occur of making new obſervations, or inſtituting experiments upon them hitherto untried: and none of the other inhabitants of our globe have been the cauſes of greater general or private viciſſitudes than this minute claſs.

The uſes of Inſects have employed the pens of many able writers; ſubjects which relate to the convenience or elegances of life are purſued with pleaſure: the Natural Hiſtory of ſilk and wax, that of Lac, Kermes, the Coccineal employed in dying, the Cantharides and Millepedes in medicine, has for that reaſon been very aſſidu-

aſſiduouſly inveſtigated. It is certain that the intention of the great Architect of the Univerſe was not confined to our apparent utility alone in their creation; but that by their aſſiſtance the earth ſhould be purified from dead animals and putrefaction, and a proper proportion and natural equilibrium kept up in the numbers of vegetables; further ends were alſo to be anſwered by them; Providence uſes them as miniſters to repreſs the arrogance of mankind, to rouſe them from their inſenſibility, to ſharpen and excite their diligence, or impreſs a conviction upon them of their infirmity and weakneſs. The conſideration of the Noxious qualities of Inſects will convince us fully of this: that the ſubject may be reſtrained in proper limits, I ſhall confine myſelf to thoſe of our own country, as it may be of uſe to my fellow citizens both to impreſs theſe important truths upon their minds, and to enable them to prevent thoſe inconveniences which otherwiſe would

would be chargeable upon our negligence or want of knowledge.

There are ſome perſons who on account of their minuteneſs and ſudden diſappearance eſteem inſects a very contemptible enemy: we diſcover nearly a thouſand ſpecies in the neighbourhood of Upſal, and their united power of damaging us muſt be equal to that of the larger animals; for though they be leſs in magnitude they ſurpaſs them ſo far in number that it amounts to the ſame thing: theſe minute plunderers are ſcattered like duſt over the fields; the little depredation of an individual almoſt eſcapes our ſight, while that of a larger animal is eaſily eſtimated: yet the united injuries we receive from ſuch myriads are of the greateſt magnitude. The ſervant who daily pilfers from his maſter ſteals more than a thief who loads himſelf once with what booty he can carry off; if we watch a Caterpillar preying upon leaves a little time, we ſhall ſee him devour a much greater

greater quantity in proportion to his ſize than the largeſt animal: we ſaw a melancholy example of this a few years ſince, when the caterpillar of a ſingle ſpecies of moth laid waſte the whole tract called King's Meadows, near Upſal.

We ſee our higher meadows and mountainous paſtures often bare and ſtripped of vegetables; we aſcribe this to the ſterility of the earth, the heat of the ſun, and the rigor of the climate; but this ought rather to be attributed to the nocturnal depredations of Inſects which by day hide themſelves in the earth, and are the cauſe of the greater damages we receive. When we attentively conſider how much detriment our property often ſuſtains from inſects, we find it of ſuch amount, that we cannot ſufficiently admire the negligence of thoſe who in their treatiſes of Oeconomics entirely neglect or ſlightly paſs it over.

If we conſider the labours of thoſe friends of mankind who in this age have dedicated their cares and attention to abridge human labour by the invention of machines, or new modes of diſpatching all the works of agriculture with ſuperior quickneſs and exactneſs; they certainly deſerve the higheſt praiſe for that induſtry and aſſiduity by which they have advanced their ſcience with greater additions than it ever before received: but when we reflect upon the injuries agriculture receives from inſects, we ſhall find that they never turned a proper degree of attention that way, but have rather entertained a contempt for enemies in every reſpect ſo formidable. Yet to judge this affair with propriety, I ſhould rather excuſe this omiſſion in them than the profeſſors of Natural Hiſtory; in whoſe province it more directly fell to inſtruct them in the nature of inſects, and the injuries we are liable to from every ſpecies. But rural œconomics will be infinitely improved when natural ſci-

ence

ence ſhall be held in more eſteem, for as (beſide all the reſt of the details of the practice of agriculture) it is neceſſary to keep our corn clear of weeds and noxious plants; with the ſame ſolicitude we muſt defend our fields, meadows, and places where we raiſe plants from noxious inſects: and that we may effect this with the greater eaſe, we muſt be very diligent in our enquiries how they are to be attacked, and by what means deſtroyed.

Wherefore that it may more fully appear how numerous and widely diffuſed our enemies of this claſs are in this country, I ſhall ſubdivide theſe inſects whoſe noxious power has been hitherto diſcovered into certain general claſſes.

CLASS I.

Inſects noxious to Man.

Pediculus humanus*.---This inſect attacks the heads of children, and by its

* Common louſe.

bite frequently cauſes inflammation and ulceration; nor are adults totally free from them, particularly ſailors in long voyages, ſoldiers in camp, priſoners, and others who have not the means of keeping themſelves clean.

The Pulex irritans*, in the months of July and Auguſt by its multiplication becomes an intolerable plague in our houſes.

The Acari ſirones inſinuate themſelves under the cuticle of man, ulcerating and covering it with a leprous eruption from head to foot; the irritation it produces is ſo intolerable, that they cannot refrain ſcratching themſelves violently, from whence ariſe ulcers, and the moſt intolerable pains.

Poſſibly we ſhall find in ſome of the ſpecies of the Acari† yet undiſcovered, the cauſe of many cutaneous diſorders; as the Herpes, Serpigo, Elephantiaſis, & Tineæ.

I enter-

* Common flea. † Tick.

I entertain no very great doubt, but rather propoſe it as a probable conjecture, that the Dyſentery, the Venereal Diſtemper, the Small Pox, Spotted Fever, Plague and all thoſe other diſtempers which are called contagious, produce Exanthemata, and makes ſuch havoc in the human ſpecies are derived from different ſpecies of the Acari.

The Acarus ricini* ſometimes ſurrounds us in great numbers: if we ſit down near them, we become totally covered with them and experience their rage. The fox-coloured and red Ant will hinder our reſting upon a bed of roſes with their pungent ſting and the venom they infuſe with them. The Forficula auricularia† ſometimes endeavours to get into the ear, and unleſs prevented brings on a headache which terminates in death. The Cimex lectularius‡ is now a very com-

* Dog-tick, B. 182. 1. ‡ Houſe-bug, B. 119. 1.
† Ear-wig.

mon evil in Europe: it fills our houſes, tapeſtry and beds, it bites thoſe who are aſleep, and allows thoſe who are waking no reſpite: its ſmell is inſufferable. The Conops calcitrans* likewiſe enters our houſes before rain, with its ſharp proboſcis piercing our legs like an awl.

Many ſpecies of the Tabanus† peſter us when abroad, eſpecially againſt a ſhower. The Culex pipiens‡ with his unceaſing buzz and ſharp bite diſturbs our morning and evening ſleep: in Lapland in ſummer, this ſpecies of inſect is a perpetual calamity of the moſt ſerious kind; the Gnats ſwarm ſo there that they dare not expoſe their faces and hands to the air unleſs they be covered with pitch. The Culex pulicaris§ hovering in the evening in great ſwarms are extremely troubleſome; their feet exciting a diſagreeable itching upon the ſkin, and their bite

* B. 178. 1.
† B. 177.
‡ Common gnat, B. 177. 1.
§ B. 178. 3.

bite an inflammation, particularly in Norway. The Hornet and Waſp attack us with their ſtings, in woods and our own houſes where we might expect repoſe. The Muſca domeſtica* enter our houſes in great ſwarms, hover over our faces and hands, and their interruption ſuffers us neither to eat, drink, or do any thing, in quiet. The Hippoboſca equina† troubles us upon a journey in the Summer, creeping upon the ſkin, and alarming us for fear of his getting into our ears. The Gryllus domeſticus‡ with his chirping is a moſt troubleſome inmate, and drives away our ſleep. A number of Spiders moleſt our windows with their dirty cobwebs, and alarm us with their venomous bite. The ſuperſtitious fears excited by the Termes pulſatorius§ deſerve no mention.

* Common houſe fly, B. 175. 15.

† B. 179. 1.

‡ Houſe cricket, B. 115. 4.

§ Death-watch.

CLASS

CLASS II.

Inſects noxious to Victuals, Clothes, Furniture, and even Buildings and other things.

The Muſca vomitoria* hovers over and lodges its eggs in freſh ſlain meat; theſe as ſoon as they receive life, taint and ſometimes entirely conſume it: this is an evil of ſuch extent that no care is ſufficient to guard againſt it.

The Dermeſtes lardarius† enters our cellars where ſalted proviſions for the Winter are kept, and devours them.

The Blatta Laponica is extremely well known to the Laplanders, devouring their dried fiſh which are kept without ſalt, in a few days.

The Silphæ‡ feed upon fleſh in moſt ſhady

* Blue fleſh fly, B. 175. 13.

† B. 88. 1.

‡ B. 91.

ſhady places, they do infinite damage to the Laplander.

The Muſca putris* lodges its eggs in the cracks of cheeſe, which being hatched there conſume the inner part, and frequently either totally corrupt or devour it.

The Acarus ſiro reduces cheeſe into a uſeleſs bran; eats our flour or at leaſt give it a nauſeous bitter taſte.

The Tenebrio molitor†, unleſs the greateſt caution be uſed, devours our ſweet cakes as his own property, and lays his eggs in flour which the Caterpillar devours.

The Formica herculearia‡ creeps through the leaſt fiſſure to get to ſugar.

The Caterpillar of the Curculio nucum,

* B. 176. 17.
† B. 111. 1.
‡ Horſe ant, B. 169. 1.

cum* perforates the nut-ſhell and deſtroys the meat.

The Blatta orientalis† is a great nuiſance to the Finland ovens. It has been brought over to Sweden, and firſt entered our mills and deſtroyed the flour; it next plundered our houſes, eating out the inſide of our loaves of bread, and leaving the cruſt untouched; it even preys upon ſhoes and clothes.

The Gryllus domeſticus‡ gnaws to pieces our tapeſtry and bed clothes, and devours or ſpoils whatever it finds eatable in the kitchen.

The Phalæna tapetzella§ deſtroys our ſilk furniture, the Pellionella our furs, the Sarcitella our woollen cloths, and do very great damage.

* B. 100. 21.
† B. 114. 1.
‡ Houſe cricket, B. 114. 4.
§ B. 155. 78.

The

The Dermeſtes pellio* deſtroys the moſt precious furs and robes trimmed with them, in the Summer ſeaſon eating all the hair off, notwithſtanding all the precautions which can be uſed of wrapping them in linen or any other covering; as the dealers in theſe commodities frequently experience to their coſt. This inſect is likewiſe a great enemy in collections of birds, nor can it be expelled by ſalts, ſcattering bitter drugs, or any other diſcoverable expedient.

The aſh-coloured Phalæna, with a long roſtrum, the upper wings marked with two lines and dotted, deſtroys the inſects preſerved in a Muſeum.

The Cerambyx fur, unleſs kept out with continued attention ruins the collection of the Botaniſt.

The Termes pulſatorius† detaches the

* B. 88. 2. † Death watch.

plants glued down in a hortus ſiccus to eat the fiſh glue with which they are cemented to the paper; all the three mentioned above prey upon preſerved inſects.

The Phalæna granella* makes terrible havoc with the corn in granaries.

The Curculio ſegetis, together with the frumentarius & granarius do more hurt to corn than the mouſe, and deſtroy it all in a little time, unleſs it be continually ventilated and caſt: when the laſt mentioned inſect gets in among lentiles, they are ſo damaged that the merchant is obliged to ſell them to a great diſadvantage or fling them away.

Profeſſor Kalm upon his return from North America informed us, that Peas were an article in which the inhabitants of the northern Engliſh provinces carried on a very lucrative commerce with thoſe of the ſouth; but he adds that it was ſuddenly loſt. The Dermeſtes piſorum multi-

* B. 155. 80.

multiplying with ſuch rapidity as to devour the whole crop, leaving hardly enough to ſeed the ground. This gentleman having brought over among other ſeeds various ſpecies of peas, found ſeveral of theſe animals ſtill alive among them; ſome of which he ſent to Count Teſſin, and the Preſident. I have great apprehenſion that this deſtructive inſect may at ſome period be brought out of America into England in their corn veſſels, from whence unleſs great care be uſed it will be propagated all over Europe.

By a ſimilar fate the ſeeds of ſome papilionaceous plants periſhed, which Monſ. Lagerſtrom, Counſellor of Commerce, tranſmitted to the Univerſity Phyſic Garden from the Eaſt Indies; being ſo entirely ſpoiled in the voyage by a minute inſect of this ſpecies, the Curculio chinenſis, that not one of them grew: this minute animal however came hither alive

with them and its natural hiſtory has been delineated.

The Dermeſtes typographus frequently ſpoils trunks of trees which are cut with their bark on to be hollowed into pipes. For making various labyrinths between the bark and the wood, it fills them up with duſt; by which the bark falls off and they become uſeleſs. The ruin theſe with other ſimilar animals work in the beams of old houſes is a fact very well known.

Many of the Cerambyces lay their eggs in wood and felled trunks of timber; theſe when hatched perforate the wood, whereby it admits rain and very ſoon rots.

The Cantharis navalis, whoſe figure is delineated and natural hiſtory given, in our Preſident's Iter Weſtrogoth, excavates the denſeſt and hardeſt trunks of oaks;

oaks; by which they become totally improper for ſhip-building.

The Chryſis ignita* perforating wooden buildings, but more particularly clay walls, contributes its aſſiſtance to the deſtruction of houſes.

CLASS III.

Inſects hurtful to Fruit Trees and the Kitchen Garden.

The Phalæna brumata† for theſe laſt ten years has made ſuch devaſtation among our fruit trees that they have produced very few or no apples; which has obliged us to purchaſe them abroad. After they had ſtripped theſe trees of all their leaves, they conſumed thoſe herbs which grew ſpontaneouſly near them. The Phalæna hortorum devours the leaves of trees and their young fruit: the P. cæruleo cephala

* B. 167. 1. † B. 154. 69.

phala* commits equal depredations. The P. Antiqua† almoſt every year preys upon the plumb and cherry, and deſtroys their fruit: the P. Pomonella‡ eats the pear and apple, the Tipula hortulana§ eats the buds, bloſſoms and flowers of plants.

The Scarabæus horticula‖ is the voracious deſtroyer of the gardens of Scania: he ſpares no fleſhy fruit but the pear, their gardeners alſo ſuffer extremely every year by the ravages of the Gryllotalpa¶ in the kitchen garden; which has other very formidable enemies the Phalæna Caia**, and the Ph. Oleracea††, which lies concealed in the day and deſtroys the herbage in the night.

Many ſpecies of the Tipulæ devour the roots of theſe plants ſo that they droop and dye.

The

* Black thorn moth, B. 145. 25.
† White ſpot tuſſock moth, B. 144. 33.
‡ Codling moth, B. 156. 81.
§ B. 171. 1.
‖ Black legs, B. 86. 8.
¶ Mole cricket.
** Great tiger moth, B. 142. 13.
†† B. 150. 50.

The Papillio braſſica*, takes its name from the plant it is ſo fatal to: it is the general cuſtom to collect and deſtroy their caterpillars with great care: but this year they committed ſuch depredation in the cabbages, that very few were ſtored in our cellars†.

The Chryſomela aſparagi‡ does great hurt to that plant at Hamburg and Ruſſia, ſo as to fruſtrate all the expence and labour of raiſing it; and the ravages of the Tipula hortulana are quite equal to the former.

One ſpecies of the Chryſomela feeds upon the leaves of the Armoracia with ſo much voraciouſneſs, that he hardly lets one eſcape.

The Curculio alliaria§ deſtroys all the plants

* Great White cabbage butterfly.

† See Note (*A*) at the end of this Eſſay.

‡ Aſparagus beetle.

§ B. 98. 1.

plants of the claſs Tetradynamia as the cabbage the Lepidium*.

The Chryſomela ſaltatoria deſtroys the ſeed leaves of our young culinary herbs, which kills the plant.

The Phalæna humuli† devours the roots of the hop which immediately ſickens, exſudes a honey dew, is covered with Aphides and withers away.

CLASS IV.

Inſects, hurtful to Shrubberies and Groves.

The Meloe veſicatorius jaggs the margin of the leaves of all the Privet in Scania.

The Phalæna caſtrenſis does ſuch hurt to the Euonymus, that it appears quite burnt up.

* Ditander. † Otter moth.

The

The P. Groſſularia* frequently ſtrips our gooſeberries and corinths to the laſt leaf.

The Papilio Antiope† totally deſtroys the beauty of the Cratægus oxycantha‡, this plant is alſo fed upon by the Phalæna avellana.

Various ſpecies of the Tenthredines§ eat away the under ſides of the leaves of the pear, plumb, and other fruit trees; and perforate them like a cullender.

The Curculio ceraſi‖ cauſes ſuch a number of black ſpots upon the leaves of pears and cherries as to render their appearance quite deformed.

The Acarius telarius¶ ſpins over the winter buds of the moſt ſcarce plants and deſtroys them; an enemy, who though

* Magpye moth.
† Willow butterfly.
‡ White thorn.
§ B. 162.
‖ B. 98. 3.
¶ B. 182. 4.

we have ſuffered every day by him has not before been obſerved.

The Coccus heſperidum* is very deſtructive to our ever-greens.

The Aphides† of various ſpecies exhauſt the nutricious juices of plants, and reduce them to a very languid ſtate.--- Though it is probable that almoſt every vegetable has its particular Aphis, as Linnæus obſerves in the Syſtema Naturæ, yet it may not be improper here to add to the catalogue thoſe of the Poplar, Willow, Vetch, and Sea orach. The elegant and expenſive collections in our greenhouſes are great ſufferers by them.

The Pediculus adonidum joins with them in their ravages, and is not eaſily gotten rid of: and to theſe we muſt join the Oniſcus millepes.

* Green-houſe bug, B. 127. 1.
† B. 124.

The

The Curculio liguſtici deſtroys the Liguſticum leviſticum*, cultivated both for its beauty and medicinal virtues.

Two of the ſpecies of the Chryſomela†, the ſcrophulariæ and cordigera‡ ſo totally extirpate all the various kinds of the Scrophularia in our Botanical Gardens, that it is with great difficulty we can preſerve a ſingle plant.

The Chryſomela merdigera deſtroys the moſt beautiful ſpecies of the lilly.

The Curculio rumicis§ ſeized with ſuch avidity upon ſome ſpecies of the Rumex in our Academical Gardens, as not to leave a ſingle ſpecimen for our Botaniſts.

The Phalæna heracleana deſtroy all the ſeed of the Heracleum‖ annually in the

* Species of loveage.
† Figwort wevil, B. 100. 22.
‡ Heart wevil.
§ Dock wevil, B. 99. 19.
‖ Cow parſnip.

ſame gardens, draws the umbels up together in a bunch, devours the flower, and bores into the ſtalk.

The Formica fuſca* turns the roots of plants out of the ground, infeſts our trees, and produces many great inconveniences.

CLASS V.

Inſects hurtful to our Fields.

The Chryſomela helxines, and the Chryſ. nemorum† have for ſome years eaten away the lobes of our ſeed corn.

The Caterpillar of the Scarabæus melolontha‡ has been diſcovered by the peaſants of Scania to deſtroy their corn by feeding upon the root: and their crops are now very frequently laid waſte in conſiderable tracts, by ſome Caterpillar whoſe metamorphoſes are not yet diſcovered.

Three

* Common ant, B. 170. 3.

† B. 96. 15.

‡ Tree beetle.

Three different ſpecies of the Curculio* get into the ears of corn and devour the ſeed. They are carried with them into the barn, where they continue their ravages.

The Phalæna ſecalina is the cauſe of the very numerous white barren ſpikes of rye.——This is commonly attributed to the coldneſs of the ſeaſon, but Rolander, in the Stockholm tranſactions, demonſtrated that the cauſe of this misfortune was the caterpillar of this moth, devouring the ſtalk at the firſt joint.

Our Preſident diſcovered that the Muſca hordei every year deſtroyed at leaſt one fifth part of the corn in the public granaries, or 109,000 tons.

The Gryllus apricarius, after laying waſte our meadows attacks our fields with equal voracity.

* Weevil.

CLASS

CLASS VI.

Inſects deſtructive to Plants growing ſpontaneouſly.

To enumerate the inſects which prey upon all our uncultivated and native plants would draw me into a prolixity which I am determined to avoid: beſide the ſubject has been nearly exhauſted by the ſucceſsful induſtry of Mr. Forſkall, who has treated of it in the Flora of Inſects: I ſhall therefore limit myſelf in this ſection to enumerate the inſects which produce moſt damage in our meadows.

The Gryllus migratorius a few years ago poured out of Tartary, laying waſte almoſt all Europe with a voracity which produced unequalled calamities: they ſwarmed over in multitudes which clouded the whole air, and deſtroyed all the vegetables. Our cattle neceſſarily periſhed with hunger, and men were forced to quit a country now become a deſert,

and

and fly to the neighbouring regions: but it is rare now to find an inſect of this ſpecies.

The Phalæna calamitoſa ſo ruined our graſs lands in ſix different years between 1740 and 1750, that the remainder of the hay would not pay the expence of mowing: by the enſuing ſcarcity it roſe to above four times the common price.

A moſt minute inſect the Gryllus apricarius, is the cauſe of that ſterility in our upland paſtures generally attributed to the ſoil or ſeaſon; indeed the whole genus of the Grylli attacking our paſtures are frequently the unſuſpected cauſe of the dearneſs of hay.

Many of the Tipulæ* devour the roots of graſs, nor are the Pond Weed, the Nymphæa, the Water Soldier, or other water plants free from them: we find them frequently almoſt eaten up by inſects.

CLASS

* B. 171.

CLASS VII.

Inſects hurtful to Foreſt Trees.

Foreſts trees by their height are protected from being fed upon by beaſts, yet they ſometimes ſuffer very much from inſects.

The leaves of the Fir in mountainous countries put on the appearance of being burnt, occaſioned by the Phalæna ſylvatica. The Tenthredo pini and the Phalæna turionella perforate it with holes which admit the rain. The Aphis pini exhauſts the juices of young pines.

The Beach is preyed upon by the Scarabæus melolontha*, the Curculio† follows it and gives the tree the appearance of being burnt.

The Birch is often covered with a yellow

* Tree beetle, B. 87. 10. † Beach wevil, B. 100. 19.

low hue, the Curculio betulæ* devouring the under ſide of the leaves.

The Chryſomela populi† frequently ſtrips a whole plantation of poplar of all its leaves.

The flouriſhing appearance of our willow grounds is almoſt every year deſtroyed by various inſects: the Tenthredo capræa‡ devours the ſubſtance of the leaf of the White willow and leave the ſkeleton: the Phalæna capræa feeds upon all the reſt of the willows.

Our plantations of Oak are frequently ſtripped of all their beauty by feeding theſe bands of robbers.

The Bird cherry is ſpun over by the Phalæna padella with cobwebs.

The leaves of the Lime tree look as

* Birch wevil, B. 99. 16.
† Poplar gold chaffer, B. 95. 10.
‡ B. 163. 7.

if they were covered over with mold from the web of the Acarus telarius*.

The leaves of the Mountain aſh turn red and are covered with the appearance of ſmall acute ſpines by a minute caterpillar they conceal.

The Elm loſes all its beauty by the Aphides ulmi†, and the Kermes, it alſo harbours the Cicada ulmi‡.

The Alder is frequently ſtripped of all its leaves by a certain caterpillar for a circuit of many miles.

CLASS VIII.

Inſects noxious to Cattle.

The curculio paraplecticus which torments horſes to madneſs, occaſions a common and moſt calamitous diſorder in our country, particularly in ſome provinces: after

* Elm louſe, B. 124. 2.
† B. 182. 4.
‡ B. 117. 8.

after they have eaten the Phellandrium* upon which this inſect in its firſt ſtate feeds, as ſoon as it is lodged in the ſtomach, it kills the horſe by making its way through the ſpinal marrow. Oxen avoid this deadly poiſon, as they are ruminating animals, and ſeldom touch the plant.

The Oeſtrus hæmorrhoidalis† occaſions the greateſt torment to horſes.

The Muſca hippoboſca, and many ſpecies of the Tabani‡, by their bite cauſe blood to flow from horſes and oxen.

The Muſca meteorica follows horſes ſo pertinaciouſly as to render a journey in Summer very troubleſome. The Culices equini in Norway, boldly attack the horſe and ſuck his blood.

* Water hemlock.

† B. 170.

‡ Horſe fly, B. 177.

The Oeſtrus bovinus* is nouriſhed in the back of the ox the whole Winter till the month of June; and plagues them ſo all the Summer, that they are obliged to fly for refuge into the water, and dare not not quit it the whole day.

The Conops calcitrans† attacks them with ſuch acrimony, that they are obliged to be upon their guard againſt them day and night: and always kicking the ground.

Lice are a fatal evil to oxen; their continual irritation bring on a leprous eruption; they alſo are found upon the horſe and ſwine which they emaciate by degrees; Oxen are alſo ſubject to the bite of the Acarus ricinus‡.

The Hippoboſca aptera, and an Acarus continually bite and emaciate ſheep; beſide

* Breeze, B. 170. 1.
† B. 178. 1.
‡ Dog-tick.

ſide they are ſo entangled in their wool that they are with great difficulty freed from them.

The Oeſtrus naſalis, of which there are two ſpecies, leave their eggs in the noſtrils of the ſheep; theſe being hatched into maggots lodge the whole Winter in the cavity of the forehead vellicating the internal membranes, and often bringing on death.

The Rhendeer of Lapland are obliged every year to fly to the Alpine mountains to eſcape the purſuits of inſects: the three following are the moſt noxious to them:

The Oeſtrus naſalis, which attacks them in the ſame manner as it does the ſheep.

The Oeſtrus tarandi; this is a great obſtacle to increaſing the breed of Rhendeer: a fourth part of their number periſh

riſh by it at two years old: the reſt are emaciated and their ſkins ſpoiled.

Two ſpecies of the Culex* and the Tabanus tarandinus pierce their horns and extract blood. The Pulex† and Acarus continually torment our dogs.

CLASS IX.

Inſects noxious to Birds.

Almoſt every ſpecies of bird is infeſted with a particular louſe; they are all deſcribed in the Syſtema Naturæ. We are moſt ſenſible of the injuries they receive from them when they kill the peacock in Winter, and in Summer make the poultry droop their wings.

The Swallows are greatly troubled with theſe inſects, they ſometimes totally cover

* Gnat.
† Flea-tick.
‡ B. 179. 2.

ver them: the Hippoboſca* frequently kills young Swallows.

CLASS X.

Inſects deſtructive to Fiſhes.

Crabs, Fleas, and Locuſtæ are great deſtroyers of fiſh in the rivers, the lakes, and the ocean.

The Oniſcus entomon†, who accompanies the herring is an enemy well known to our fiſhermen: they will frequently eat up a whole fiſh while it hangs in the net.

Many ſpecies of the Dytiſcus‡ torment and frequently kill the fiſh in our ponds.

* B. 179. 2.
† Sea wood louſe.
‡ Water chad, B. 108.

CLASS XI.

Inſects deſtructive to others.

The Acarus coleoptratorum* is frequently found adhering to the abdomen of the Beetle, and a moſt troubleſome gueſt. The Coccus coleoptratorum likewiſe frequently fixes upon this inſect and feeds upon him.

The Carabus† and Cincindella devour all the inſects they find under ground, with the voracity of beaſts of prey.

The Phalæna melonella eats up the Honey-comb;——Hornets and Waſps are beſide more dreadful enemies to the Bee than the Kite to Fowls.

The Caterpillars of ſome Phalæna, which prey upon the leaves of trees, are ſome-

* Beetle tick, B. 183. 7. † B. 109. 106.

ſometimes ſo totally extirpated by the Carabus ſycophanta, that there remains no trace of their exiſtence but their ravages.

As therefore we have now ſeen thoſe armies of inſects which our country produces deſtroying corn fields, meadows, and gardens; ſtripping our woods of their verdure, attacking man himſelf, entering our houſes, deſtroying our victuals, clothes and utenſils; wounding and torturing the reſt of the animal creation, beaſts, fiſhes, and birds, and by civil war deſtroying one another, we muſt upon the whole pronounce, that no poſſible evil can ſurpaſs thoſe which they have at certain periods brought upon us, or what we may ſuffer from them in future, unleſs proper means of prevention be diſcovered: and that mankind has been much more injured from theſe minute animals, than from thoſe of a bulk infinitely ſurpaſſing them. I am happy

therefore to ſee that in my country and this univerſity, our attention has been by degrees (among our other ſtudies) turned to inveſtigate the nature, and give the deſcription of Inſects. And unleſs the pleaſure of dwelling upon ſo flattering an idea deceives me into the belief of it, I hope (and with ſome appearance of probability) that Nature oppoſes no invincible obſtacle to our diſcovery of ſuch preventive methods, as will in future protect us from the devaſtations Inſects often make: and I reſt aſſured from a more cultivated knowledge of the ſubject, we ſhall find in theſe minims of exiſtence, new cauſes to acknowledge the wiſdom and goodneſs of Providence.

The pieces upon Inſects are here placed together to bring the different Eſſays ſo intimately related into one point of view as nearly as poſſible. But the identity of the ſubject, and the ſtated lengths of Academical Exerciſes, have layed the writers frequently under a kind of neceſſity of repeating what had been as well or better

ter ſaid before: theſe repetitions I have omitted in the ſubſequent Diſſertations. Thus this piece begins with a ſketch of an account of the beſt authors upon inſects, and with obſervations upon their particular characters, but in the Hoſpita Inſectorum Flora we have a detailed hiſtory of the capital writers upon this ſubject, with a critique upon their works: the tranſlation therefore commences at the ſecond ſection.

(*A*) The time of the female Butterfly laying her eggs laſts but a few days; if the plants were at that time watched it would be very eaſy to deſtroy them by the help of the net: the numbers of the parent inſects who live out the Winter, being very few.

DISSERTATION X.

MIRACULA INSECTORUM,

BY

EMANUEL AVELIN.

Am. Acad. v. 3. p. 313.

SUMMARY.

Natural Hiſtory begins by examining the larger objects, and deſcends progreſſively to the moſt minute——Inſects objects of ſuperſtitious fear —— inſtances—— Phalæna calamitoſa——Apis centuncularis —— Showers of blood, Comma butterfly —— Monoculus pulex —— Sphinx

Sphinx atropos——Furia infernalis——confirmed by the American Nigua——Various galls of oak——poplar——Terebinth——Ceraſtium——Sphex cribaria food——Sphex hirta, inſtances of its art——Luminous inſects——Natural Phoſphori——Nereis noctiluca——deſcription——Hiſtory——Acarus ſiro proved to be the cauſe of the Itch——concluſion.

WHEN we are introduced into a fine palace, our attention is firſt ſtruck with the general form of the whole; we next conſider the larger parts in ſucceſſion, and at the laſt the mind becomes ſo diſengaged as to extend its examination to the execution of the minuteſt ornament. It is the ſame when we begin a Philoſophical ſurvey of that noble edifice reared by the great Architect of Nature: The reſearches of the Botaniſt

began

began with the greater and more ſtriking Genera of the vegetable world, but were not completed, until in the preſent age, the Natural Hiſtory of the moſt minute moſs had been accurately deſcribed: the larger animals naturally firſt occupied the attention of the Zoologiſt, but his ſcience will not have attained the requiſite degree of perfection before it has fully delineated and deſcribed the moſt minute.

* Inſects certainly deſerve a proper degree of attention: the effects they ſometimes produce are ſo great, that a popular and unenlightened ſuperſtition has raiſed them into prodigies: I ſhall give an inſtance or two of this, as the beſt principles never run innocently into abuſe.

Many years our graſſes ſuffer a great deal from Caterpillars in the ground: ſome of our neighbours obſerve ſolemn faſt days for their diſperſion; when the middle

* See Note (*A*) at the end of this Eſſay.

middle of the Summer comes they vaniſh, and their departure is celebrated by a day of thankſgiving; this happens about the feaſt of St. John, when the Caterpillars of the Phalæna calamitoſa aſſume the form of a Chryſalis, and afterwards make their appearance only in the night to lay their eggs for the next year.

Reaumur gives us a hiſtory of a gardener, who digging in a garden found the neſt of thoſe bees who produce the Centunculus: this was rolled up and platted with ſo much art, that he imagined it never could be a natural production, but muſt be a ſpell left there by witches to do ſome damage to the ground or the inhabitants. However taking the precaution to guard his hands with a pair of gloves, he took it up and ſhewed it to ſome perſons of the neighbourhood, who looked upon it as a charm of no ſmall potency.——He then laid the ſtate of his apprehenſions before the Curè, and told him

him his fears that there were ſome conceal-ed witches or enchanters in the congrega-tion, who wanted to damage his grounds. ——The Curè impreſſed deeply with the ſame apprehenſions told him, that in his reading he had met with accounts of ma-gical knots, but had never ſeen any before; and preſſes him very ſtrongly to take a journey to Paris to ſhew them to his Maſ-ter; that he might eſcape all ſuſpicions of being engaged in ſo horrible a villainy. He reaches Paris, and with a moſt miſe-rable accent and miſerable countenance recites the whole of this alarming diſco-very: his Maſter unacquainted with the ſubſtance conſulted his ſurgeon, he being no Naturaliſt, they agreed to take the opinion of Monſ. Nollet; who produc-ing ſome ſimilar ſpecimens, acquainted them that this Centunculus was the ha-bitation of an inſect, and began to open one of the partitions: the poor gardener was in an agony of horror, expecting every moment the moſt dreadful conſe-

quences from this temerity; however Monſ. Nollet extracted an embryo of the Apis centuncularis, which had conſtructed theſe cells of roſe leaves, without the leaſt hurt to any body preſent; and this magical apparatus turned out to be the habitation of an innocent bee.

Showers of blood, with which the walls of our churches, houſes, and our hedges are ſometimes covered, have ſtricken whole cities with a panic as the moſt dreadful of prodigies: a ſhower of this kind fell about Aix in Provence, in 1608; the common people were terrified with the apprehenſion of ſome great general calamity; but Peirecius enquiring into the affair with a great deal of attention, found that theſe drops were ſcattered by an innumerable ſwarm of the Papilio C. abum* hovering in the air: he preſerved ſeveral of the caterpillars of this inſect in a glaſs, which after their transformation let fall theſe drops of blood. This unlucky

* Comma butterfly, B. 133. 22.

unlucky diſcovery ruined two hypotheſes which had been ſupported with great and equal ability, one that it was the work of evil ſpirits, the other (that of the naturaliſts) that theſe drops were formed from red exhalations precipitated again in rain.

The diligent Swammerdam relates that as he was ſitting one day in his cabinet, he heard a great rumor and alarm among the people; when he had enquired into the cauſe of it, he found it was occaſioned by the water of Leyden being turned (as they imagined) into blood: but by an examination of it he diſcovered that the change of colour was derived from the Monuculus pulex*: Merret, in his treatiſe de Pluviis ſanguineis confirms this account.

The Sphinx atropos† is another object of theſe ſuperſtitious fears from its co-

* Greeniſh red Monoc: B. 186. 2.

† Jeſſamine hawk moth, B. 138. 6.

lour and marks: it has a prominence on the back like a ſcull, and its ſound is like that of the crying of an infant: the inhabitants of ſome provinces in France where in particular years it abounds greatly, not only think it an omen of calamity, but that the figure of a death's head upon the back preſages the plague or ſome contagious diſorder.

A Swediſh country gentleman of the name of Roſbæck being out early one evening, felt ſomething make a puncture upon his hand; the mark was undiſcoverable, but ſuch excruciating torture (Cocyta) attacked him in the place, that the loſs of his ſenſes or death was to be apprehended: he recovered by ſlow degrees after the pains he had ſuffered, nor was the cauſe of it found out.

The people of North Bothnia generally affirm that when their immenſe waters are dried up in Summer, ſomething floats

floats in the air which falling any where upon the body cauſes the moſt horrid pains; but if it fall upon any eſſential part, or be taken down with the food, it produces inevitable death: wherefore as ſoon as the pain is felt the part is cut off. James Eſwaſt, a breeder of ſheep in Keimi, ſome years ſince ſent a ſpecimen of this peſt to our Preſident; (Furia infernalis) its form was that of a very minute worm, but ſo dried up that it could not be known; it was obſerved to fall into a plate at dinner: in Finland likewiſe not only men but cattle and ſheep are liable to this deplorable accident. Sometimes, a few days after the pain commences, they diſcover a duſky yellowiſh ſpot on one part or other of the body: various means but all ineffectual were applied to the cure of it, till it was by accident diſcovered that if freſh cheeſe curd be laid to the part, the pain abates, and a minute worm of about two lines in length comes out of the puncture into the curd, which perhaps

perhaps it prefers to other food. The Finlanders now make uſe of it as a ſpecific remedy.

This miſerable diſorder at preſent very ſeldom affects the ſouthern part of Europe, but formerly it was not unknown there. Peter Naaldyck a Hollander, but a phyſician of Gottenburg, author of a work entitled Libri Philippicorum de equis has the following paſſage: *That worm called by the Dutch, de Viver, is extremely fatal; it kills in the ſpace of an hour, and therefore is not improperly called the Death worm: it is only to be cured by cutting the part out, or burning it with a hot iron.*

Thoſe who are ſkilled in the Natural Hiſtory of Europe alone, will admit the truth of this fact with reluctance; but thoſe who have travelled in America, will be able to reſolve this difficulty from ſimilar things obſerved there: there is a minute in-

ſect

ſect, a ſpecies of the Flea, called the Nigua, which has a ſmall fork in his tail ſimilar to the Podura; upon which account it is not improperly named the Pulex penetrans: it is very well deſigned by Cateſby in his firſt volume of the Hiſtory of Carolina. This minute flea ſecretly perforates the ſkin of the feet and lays its eggs; which produce pains, inflammation, gangrenes and death, unleſs the the part be cut out with the greateſt exactneſs and care: Ulloa mentions the ſame inſect in his voyage to Peru, and many other American travellers.——It is a well known fact, that only the Indian Aquatic plants will bear our cold climate; Hence we ſee the Iſoetes*, Nymphæa†, Scirpus & Sagittaria‡, common to the hotteſt parts of the torrid Zone, and the ſevereſt latitudes of the North: but they always grow with us at a diſtance from the ſhore leaſt they ſhould be deſtroyed by

* Quill-wort.
† Water lilly.
‡ Club ruſh.

by the ice: and in like manner inſects the natives of India, may depoſit their eggs in our muddy lakes; which being dried in Summer may hatch and be multiplied every year, as the life of the minuter inſects is generally annual. But if I might advance a conjecture of my own upon this ſubject, I ſhould ſuppoſe that this pain was cauſed by a viviparous inſect dropping its young, which immediately penetrates the ſkin; in the ſame manner as the Gad fly drops its eggs upon the back of an animal. Some have imagined this inſect to be the Gordius*, which in a flying ſtate drops its eggs upon animals, and that they produce theſe dreadful effects: but this I ſhould admit with difficulty, as it is not founded upon obſervations, and is contrary to the general nature of worms. Whatever it be, it deſerves the diligent attention of our Naturaliſts, as it would if diſcovered lay open ſome very intereſting particulars, and be of the greateſt

* Horſe hair worm, B. 189. 1.

greateſt utility to the inhabitants of North Bothnia, where this evil is very frequent.

In the Spring of 1694 a very remarkable appearance was obſerved upon the oaks in Germany; galls hanging down like chains: the common people who had never obſerved them before, imagined them to be magical knots. They were produced by that ſpecies of the Cynips delineated by Reaumur, in the 40th table of the third volume of his Hiſtory of Inſects.

In the Summer mornings our countrymen frequently obſerve a black duſt like gunpowder ſcattered equally in the paths; they are aſtoniſhed to ſee it move and leap, and think it unlucky to tread upon it; not knowing that it is nothing more than innumerable Poduræ*, a very minute animalcule.

The black poplar produces on the foot-

* B. 180.

ſtalk of the leaves a monſtrous growth, red berries of the ſize of a cherry; protuberant on the one ſide, and cracked on the other; this nouriſhes the Aphis burſaria. The Populus tremula has ſimilar protuberances the ſize of a pea, in which the Tipula junipera reſides: its leaves are cut by other inſects, and drawn up in a form ſimilar to the cone of a cowl, with the margin radiated, and a little curled; the work of theſe inſects is very admirable.

The Oak bears red globular galls on the lower diſk of its leaf inhabited by the Cynips quercûs folii*: another ſpecies dwells in the hemiſpherical gall of the ſize of a ſplit pea; a third† lives upon the foot-ſtalk near its bud; and a fourth‡ in the bud itſelf: Its flowering ſpikes are ſometimes turned into branches of aggregate globules which nouriſh their proper inſects; and it is by the ſame cauſe

* B. 162. 3.

† C. Quercus petioli, B. 162. 4.

‡ C. Quercus gemmæ, B. 162. 5.

cauſe that the leaves of the Elm are drawn up in the form of a bladder.

The Piſtacia terebinthus produces bladders or pods a ſpan in length, totally different from the proper fruit of the tree; they are equally ſubject to this excreſcence in Spain and the Eaſt Indies. Loſling deſcribed them in a letter to the Preſident from Madrid. ——— *In Eſtremadura I ſaw (ſays he) the bladders of the Terebinthus in ſufficient plenty; they are vaginiform, dilated, empty, diminiſhed towaed the baſe, and cracked; they are cauſed by a very minute inſect of which I could hardly diſcern the genus, being quite powdered with a meal which covers the inſide of the bladder. I take them to be a ſpecies of the Aphis, unleſs from the latter circumſtance they be rather to be referred to the Kermes: it is certainly admirable ſo minute an inſect ſhould produce a bladder of ſuch magnitude.*

The Chermes ceraſtii inhabits in the fructification of the Ceraſtium viſcoſum*, which becomes totally changed in its figure; the petals are diminiſhed, the calyx becomes increaſed to three times its common length, and the leaves inflected ſo as to form a round head.

The Sphex cribaria†, which is the Ichneumon waſp of Ray‡, *with its fore-feet as it were provided with ſhields*, is an inſect of a very wonderful nature, gathering the empty veſicles of the farina which has diſcharged its pollen from the ſtigmata of flowers; thus living only upon bran.

Ray, in his Hiſtory of Inſects, page 254, mentions another Ichneumon which he ſaw in the month of June. *I do not (he writes) recollect the ſpecies, it was one of the largeſt of this genus; but obſerved it dragging a green Caterpillar three times its own ſize; when it had brought it about five yards (I looking on) it laid it*

* Broad-leaved mouſe-ear chickweed.

† B. 167. 2.

‡ Ray, p. 255.

it down near the mouth of a little burrow it had made in the ground; then removing a little ball of earth with which it had covered the orifice, it firſt went down and after ſtaying a ſhort time returned, and ſeizing the Caterpillar again, drew it down with him; then leaving it there, came up, and taking ſome ſmall globules of earth rolled them one by one into the burrow, ſcraping the duſt in by intervals with its fore-feet in the manner of a dog; thus alternately rolling in pieces of earth and ſcraping in duſt, till the hole was full; ſometimes going down as it ſeemed to me to preſs down the earth, and once or twice flying to a fir tree which grew near, perhaps to get turpentine to glew it down and make it firm: the hole being filled and equalled with the ſuperficies of the earth, that its entrance might not be diſcovered; it took two fir leaves which were near, and laid them by the mouth moſt probably to mark the place: this obſervation of Ray was confirmed laſt year by Rolander, at Upſal——The inſect was the Sphex hirta.

The

The Cicada ſpumaria ejects a froth conſiſting of innumerable bubbles from its tail, which hides it from birds and inſects of prey when in the ſtate of a Caterpillar and Chryſalis.

The Muſca tenax* poſſeſſes a property almoſt repugnant to the phyſical laws of Nature. Its Caterpillar beaten with wooden hammers, and compreſſed with the force of ſcrews yet ſurvives all this violence.

The Cantharis noctiluca, which is frequently found in paſtures and under Juniper trees, ſhines by night; In Italy and North America a ſpecies of winged Canthariſes, (drawn and deſcribed by Columna) remains all night on ſhrubs and the branches of trees, emitting light; but on the approach of any enemy inſtantly fly off, and the whole tree ſeems on fire: this wonderful light which has no connection either with culinary or electric

* B. 174. 5.

electric fire, is placed in the ſegments of the abdomen of the inſect while it remains alive.

The Cicada lanternaria (very frequent at Surinam) has a large tubercle covering almoſt the whole head, which by night gives a light of ſuch brilliancy and ſize as to ſerve in the place of a lantern.

Many ſpecies of fiſh are obſerved to have the property of emitting light in the dark: a ſpecies of the Sepia called the Polypus by Bartholinus, when diſſected in the night ſhines with a moſt vivid light, equal to the flame of fire; this luminous ſubſtance lays between the ſkin and muſcles, and its ſplendor encreaſes as the fiſh grows putrid: the Muria lapidea is an inſtance of a natural phoſphorus of the foſſil kingdom, the Byſſus violacea of the vegetable*: and Griſellini in the year 1750 diſcovered, that the luminous appearance of the ſea by night was cauſed by the Nereis noctiluca.

As

* From Charles Frederic Alder.

As Italian books of Natural Hiſtory do not frequently reach Sweden, I take the greateſt pleaſure in communicating his deſcription of an inſect, the novelty of whoſe properties will doubtleſs engage the cultivators of this ſcience here, to verify and extend his obſervations.

NEREIS NOCTILUCA*.

HEAD roundiſh, flattened, with the roſtrum extending to a point.

TENTACULA (feelers) two, very ſhort, ſubulate.

EYES two, prominent, on the ſides of the head.

BODY conſiſting of twenty-three ſegments, diminiſhing toward the tail; the ſide of every ſegment has a conical Apex cut ſhort at the vertex, and denticulated; from which ſprings a ſmall pencil of hairs, under each pencil a filament

* B. 193. 1.

ment reſembling, a foot, ſubulate flexible, unarmed.

COLOUR, glaſſy, pellucid.

LENGTH, two lines.

HABITATION, ſea plants as the Fuci & Algæ; which ſometimes it leaves, and wanders on the ſurface of the ſea.

This inſect is frequent in all ſeaſons of the year, but particularly in Summer; and on the approach of a tempeſt, when it ſeems through inquietude to give a much greater quantity of light; its appearance alſo is very brilliant when the wind is in the Eaſt and South-Eaſt points, and in winter nights preceded by a warm day: if water containing theſe animacules be kept warm, they retain their light two whole days after they are dead; but in cold weather loſe it in eight hours: motion and warmth which in-

creaſe their vivacity and ſtrength, increaſe their light alſo.

The Acarus firo, which is ſo minute as to be almoſt inviſible to the naked eye, and which corrupts flour, is the ſame animal with the Acarus humanus ſubcutaneus, the cauſe of that filthy and troubleſome diſorder the Itch.—— Thoſe who have attentively examined this eruption find that it makes its firſt appearance as a ſmall bliſter, and at a little diſtance in a wrinkle of the ſkin there appears a minute yellowiſh-brown ſpot, not yet bliſtered but becoming a bliſter in two days: a very ſmall inſect is extracted from this with the point of a needle, which being placed upon the nail, puts itſelf in motion if breathed upon: when viewed through a Microſcope it appears to have eight feet, and a few hairs upon the back, and to be the very Acarus mentioned above. By their multiplication they cover the whole body with a leprous efflorescence; the truth

of

of this is very clearly proved by a practice frequently uſed to new born infants; the Flowers of Zinc or ſome white powder is ſprinkled under their arm-pits, chin, and other parts, to dry up any humidity and prevent excoriation. If the flour of wheat be made uſe of for this purpoſe, which frequently abounds with Acari, the infant is firſt attacked in that part with the Itch which in a little time covers the whole body.

If we were to run over every kind of Inſects, and deſcribe the wonders diſcoverable in them, we ſhould ſooner find a deficiency of time than of examples; nor are the limits of an Eſſay or my imperfect knowledge of the ſubject equal to ſuch an undertaking: but conſcious how inferior my beſt ability is to the taſk, I here ſubmit its firſt exertion to the candour and benevolence of the Reader.

(*A*) In this Eſſay I have omitted ſeveral articles which are but repetitions of obſervations contained in the three former. I have likewiſe taken the ſame liberty with a very long Preface in which the ſuperſtitious apprehenſions raiſed by ſome ſpecies of inſects are exploded; in this country the ſubject does not want to be treated in that point of view. In this part of his work Avelin likewiſe conſiders the ſmall degree of eſteem with which this part of Natural Hiſtory is conſidered by many; this likewiſe has been before ſufficiently diſcuſt.

In the form in which the Diſſertation ſtands it is a ſupplement to thoſe preceding it; to make it more complete, I have incorporated with it the natural hiſtory of the Nereis Noctiluca, by Carolus Fred. Alder, which was publiſhed ſeparately in the Amœnitates. Art. 39. vol. 3.

DISSER-

DISSERTATION XI.

ON THE

SILK WORM,

BY

JOHN LYMAN.

Am. Acad. v. 4. p. 553.

SUMMARY.

Introduction——Uſe of SILK *diſcovered by the Chineſe —— Serica of the ancients cotton?——makes its way into Perſia ——uſed by the Greeks from the time of Alexander —— adopted by the Romans ——Juſti-*

——Juſtinian acquires the SILK WORMS *eggs —— Culture makes little progreſs ——introduced into Sicily by Ruger—— Naples—— ſeveral kingdoms ——* FOOD *——various foods——Mulberry generically——ſpecies——White mulberry moſt proper food of the Silk worm——black ——food indifferent——Red——native of Canada, good food——Tartarian—— Indian ——* ON KEEPING THE SILK WORM *—— eggs how kept—— young worms——food and precaution——cleanlineſs——pans——worms to be kept in the houſe——Life of the Caterpillar divided into five periods by four times of ſleeping—— periods deſcribed——directions and precaution to be uſed during thoſe periods——ſpinning——deſcription of the cone——Phalæna.*

THE

THE ſum of money annually carried out of the kingdom of Sweden for the purchaſe of ſilk is ſo great, that I flatter myſelf I ſhall do a uſeful thing to my country, if I demonſtrate that the Silk worm may be bred in this climate: for which purpoſe I ſhall here give the natural hiſtory of that inſect, and its food, the mulberry.

CHAPTER I.

It is probable that the Chineſe firſt diſcovered the uſe of ſilk, as the Silk worm is naturally produced only in that country; and its inhabitants have applied all the advantages Nature has conferred upon them with the moſt ingenious dexterity and induſtry. There is a moth found in Aſia, and in multitudes in China, whoſe caterpillar ſpins cones of ſilk of a very great magnitude, which ſometimes unwinds in threads of many ells in length, more firm and tenacious than ſilk; but the

the caſes are very difficult to unravel and are commonly carded: this ſpecies is called the Phalæna atlas, and feeds upon the leaves of the Citrus; it is alſo a native of America, and was found by Merian in Surinam.

The Poets have pretended, that a nation called the Ser, or Seres, firſt found out and applied ſilk to uſe, from which it obtained the name of Serica: but as they have told us that it was included in the fruit of a certain tree, it is moſt probable they meant cotton: we ſhall not enter into any diſſertation upon this queſtion, as it would make very little to our preſent purpoſe.——The culture of the Silk worm, paſſing through the intermediate nations, was received by the Perſians from the Chineſe; and the Greeks acquired the knowledge of its uſe from the latter in the war of Alexander; but not the modes of producing and preparing it. When the reſt of the arts and ſciences

paſſed

paſſed from them to the Romans, they received that of manufacturing ſilk likewiſe in the imperfect ſtate in which Greece then poſſeſſed it.——Juſtinian, the political Sovereign of the Eaſtern empire, ſeeing how much money went annually out of his dominions to the Perſians for this commodity, in the year 533 ſent two agents into the country, to diſcover the art of preparing ſilk, and to bring back with them the Silk worm moth; but theſe inſects dying in the journey, his endeavours were this time defeated.——He ſent others, who bringing back the eggs, the Silk worm for the firſt time became naturalized in Europe. In the beginning, the ſucceſs of this experiment was retarded by ſuch obſtacles, that the production of ſilk did not make its way into Sicily until the year 1130, in the reign of Ruger; who afterwards introduced it into his newly acquired kingdom of Naples: from whence it was adopted in Italy, Spain, France, and Pruſſia.

CHAPTER II.

The moſt grateful and healthy food of the Silk worm is the Mulberry; and wherever that will grow, there ſilk may be produced.——It is very well known that this caterpillar will feed upon the leaves of the Lettuce, Cichory, Dentdelion, Elm and Nettle; and Bellonius ſays, that in Ethiopia it feeds upon the leaves of the fig: but the ſilk produced is then weaker, and the Silk worm has a languid unhealthy appearance, and frequently dies. To obtain a ſilk of the firſt quality the caterpillar muſt be fed with the mulberry.

This tree has a very near Botanical affinity with the nettle: the flowers are diſtinctly male and female, the former with four ſtamina, the latter two piſtilla. Some ſpecies of the mulberry bear male and female flowers upon the ſame, others upon ſeparate plants. The true female tree

tree bears berries though no male be near; in which caſe the calyx becomes ſucculent and aſſumes the appearance of the fruit, but does not produce a pulpy pericarpium. In the ſpecies plantarum various kinds of the mulberry are enumerated; the white, the black, the red, the Tartarian, the Indian, the Papyrifera and the Tinctoria: we do not yet know whether the leaves of the two latter are a proper food for the Silk worm.

The white mulberry grows ſpontaneouſly in China, which is held to be the native place of the Silk worm; this gives us ſufficient ground to believe that it is the beſt food for this inſect. With us it is kept in the green-houſe part of the year, but ſtands the Winter in the Gardens of Scania.——As our countrymen have paid very little attention to the culture of ſilk, this ſpecies is very ſeldom ſeen with us, its berries being of an inſipid flavour. It appears by a ſeries of obſervations of the Thermometer, that

the Winters in China about Pekin (where this plant grows ſpontaneouſly) are as cold as our own; from whence we may conclude that it will bear our climate. This is confirmed by our Preſident, Linnæus, in his Tour in Scania, who obſerved that this ſpecies of the Morus bore the intenſe Winters of 1739 and 1741 in the open air in the gardens of that province. The leaves of the white Mulberry are tenderer than thoſe of the other ſpecies, and therefore a better food for the young worms. What has been adduced I think proves ſufficiently that this tree will bear the climate of South Scania, Bleking and Halland; which tracts would produce Mulberry trees enow to furniſh all the ſilk conſumed in Sweden.

The black Mulberry which bears eſculent berries of a very agreeable taſte, is eaten by the Silk worm though its leaves be rather hard and tough. This is common

mon in the green-houſes of Upper Sweden, but the gardeners principally chooſe the female tree, the male producing no berries: it bears a moderate Winter in the gardens of Scania; but as that ſeaſon has been very ſevere for theſe laſt eighteen or nineteen years in Sweden, many have been cut off by the froſt, particularly in the years 1739 and 1741, when almoſt all the trees of this ſpecies in Scania (except one in the Market-place at Yſtad) ſuffered ſo much that they produced no leaves the following year: a great number of people cut down their Mulberries as being dead, but thoſe who let them ſtand, found that in the year after (1742) they budded and bore leaves. This ſpecies of the Mulberry may be planted with advantage in the ſouthern provinces of Sweden; but it is neceſſary to obſerve that it delights in a moiſter ſoil than the reſt, and a ſituation on the coaſts expoſed to the winds.

The

The red Mulberry is peculiar to America. This produces larger leaves than either of the two former; tenderer than the black, but not ſo tender as the white Mulberry: and when the leaves of the three ſpecies are preſented together to the Silk worm, it firſt eats the white, then the red, and laſtly the black. The Botaniſts inform us that the red Mulberry grows wild about Quebec where the Winter is equally ſevere as in Sweden; this circumſtance induced our Preſident, with ſeveral other members of the Academy of ſciences at Holm, to propoſe that ſome perſon well verſed in Natural Hiſtory ſhould be ſent over into North America; who ſhould endeavour to diſcover (among other things) whether this ſpecies could be cultivated to advantage in Sweden, and what kind of ſilk the worms fed upon it would produce. The celebrated D. Kalm, now Profeſſor of the Univerſity of Aboe, undertook this dangerous and laborious commiſſion and executed it with

ſuch

ſuch ſucceſs, that this tree is now ſeen in the moſt flouriſhing ſtate in ſeveral of our gardens: but as we have had no very ſevere Winter ſince the time of its introduction, a perfect judgement cannot yet be formed about it: in the mean while we have already diſcovered that it affords a very grateful food to the Silk worm, and that the ſilk is by no means of an inferior quality*.

Profeſſor Hienzellman, who made a tour in Aſia, ſent our Preſident dried ſpecimens of the Tartarian mulberry which he found growing in the woods near Azow, the mart upon the Tanais. The latitude and the thermometer demonſtrate that the Winters there are colder than with us, but as this plant has never been cultivated in the gardens of Europe, we cannot pronounce any thing concerning its uſe in rearing Silk worms.

* See Note (*A*) at the end of this Eſſay.

The

The Indian mulberry is deſcribed in the Hortus Malabaricus, and by Rumpfius in his Actuarium, p. 8. t. 5 : but as its gems are imperfect there is little probability that it would be able to ſurvive a European Winter: therefore though theſe two latter ſpecies may furniſh proper food to the Silk worm, we ſhall paſs them over as unknown or uſeleſs.

CHAPTER III.

We may have Silk worms eggs ſent incloſed in a letter or otherwiſe from the ſouthern parts of Europe, the ſevereſt Winter does not affect them. They are to be preſerved in a cold place leſt they ſhould be hatched too ſoon by warmth before mulberry leaves can be obtained for them: they ought to be kept in a cellar in glaſs bottles for fear of mould, and to guard them from inſects, not to be ſet out to hatch before the Mulberry

leaf

leaf appears, and then to be expoſed in a warm ſituation. They are from four to eight days in hatching: the caterpillar when it firſt appears is ſmall and black, it is commonly fed with the leaves of lettuce until its teeth become hard, eſpecially if the leaves of the Mulberry be grown large: afterwards it is to be furniſhed with Mulberry leaves; but particular care is to be taken that they are neither dry and parched, or wet with dew and rain; in the latter caſe the inſect contracts a diſtemper ſimilar to the dropſy. They muſt have freſh leaves as often as the old are finiſhed or become dry; theſe together with their excrement muſt be thrown away, as their ſmell and dirt produce diſeaſes which deſtroy them. The Chineſe have an excellent method of covering the bottom of the pans in which they are fed with a net, when the leaves are finiſhed in the bottom they aſcend into the upper pan, which is filled with freſh food which they eaſily find out;

and by this means are liable to no hurt in being removed by the hand or an inſtrument. The time from the hatching an egg to the caterpillar's ſpinning is nearly five weeks, during which time it muſt be kept in the houſe to protect it from dews and cold air, from birds, and the Ichneumon fly; we ſhould likewiſe be upon our guard againſt vapours.

The life of a Silk worm before it puts on the form of a Moth is divided into five different ſtages, which are ſeparated by four times of ſleeping: from a knowledge of theſe periods we may diſcover their age and the diſorders to which they are then liable.

The firſt period commences at their hatching and laſts ſeven days, until the worm caſts its black ſkin: whence its firſt ſleep is called the Somnus niger (black ſleep) during the two laſt days of this period it eats very little.

The

The ſecond laſts eight days, when it again ceaſes to eat and appears with a white ſkin: the ſleep with which this period concludes is named the Somnus albus (white ſleep).

The third period conſiſts of eight days, when it changes its ſkin a third time: the ſleep at the end of this is called the Somnus deſquamationis (ſcaling ſleep.)

The fourth period is of eight days at the end of which it gets its laſt ſkin: the ſleep is called Somnus excorationis (flaying ſleep).

In the fifth period it eats for ſeven days, then leaves off and begins to ſpin.

Theſe five periods between which four ſleeps intervene will direct the perſon who rears Silk worms in the buſineſs of feeding them. In the firſt they are to have freſh leaves frequently in the day; in the ſecond twice morning and evening; in

the third they require freſh leaves at leaſt three times; in the fourth oftener, as they eat with ſuch avidity that you may hear the ſound of their teeth; in the fifth period they muſt be plentifully fed: if they be ſuffered to hunger they will produce very little ſilk. While they ſleep, no leaves are to be given them but they are to be left quiet; therefore caterpillars of the ſame age are to be kept together in diſtinct pans, not young and old mixed indiſcriminately. The pans are not to be changed while they are in a ſtate of ſleep, as the greateſt quiet is neceſſary at that time. We ſhould beſide allow them ſufficient ſpace; for if many of them be cloſely crowded together they become ſick, are liable to contagious diſorders and periſh in multitudes.

In the firſt period great care is to be taken that they receive no damage from cold; therefore if the weather be cold a fire muſt be kindled in the room.——

When

When they are grown larger this becomes of no conſequence, and they may be kept in any houſe provided the windows be not too much expoſed to the noon-day ſun; care muſt likewiſe be taken that they be not incommoded by the heat of the fire or bad ſmells in the houſe; Mice, Birds and the Ichneumon are equally enemies to them. The room where they are kept is generally built round with ſhelves like a library, upon which the pans for the Silk worms are placed. Our care ought always to be employed that they never want food of freſh leaves, that the place be clean from all filth; that the air be dry, neither ſuffocating or putrid; that the heat be not too great, and that thoſe which are ſick be removed as early as poſſible; theſe are eaſily diſcovered by the ſad colour of their ſkins.——After they have abſtained from food two days they appear pellucid, with a ſhining ſmoothneſs, and begin to ſpin in order to go into a new ſtate: they are then furniſhed

furniſhed with a certain organ under the mouth with two pores, through which they ſecrete a viſcid liquor which becomes rigid in the air, and appears in the form of two threads; of this the cone of the Silk worm is formed, which conſiſts frequently of a thread of one hundred yards in length, about the ſize of the laſt joint of the thumb: the difference of the colour of the ſilk, white or yellow, is to be reckoned only as a variety.

The cone is perfectly finiſhed in one or two days, and the caterpillar is transformed into a Chryſalis. Thus it remains for a fortnight immoveable without mouth or feet; it then flings off the the covering of the Chryſalis, and vomits a liquor which (as a true menſtruum of the ſilk) eats through the cone, and the moth iſſues out, vibrating its wings to dry them. It now makes its appearance as the Phalæna bombyx.

PHALÆNA BOMBYX, no trunk. Antennæ comb-formed, wings reverſed whitiſh. With tranſverſe lines almoſt evaneſcent, tawny yellow; marked with a creſcent.

The Moth is of a middle ſize, paliſh white; the eyes black; the Antennæ white, comb-formed, it is furniſhed with black teeth; the upper wings whitiſh, with tranſverſe lines almoſt evaneſcent, of a faintiſh tawny yellow, excavated toward the top, marked with a creſcent in the middle of the diſk; lower wings broader, toward the tail, exceeding the breadth of the upper wings, and projecting beyond them, with an obſcure ſpot on the membranaceous margin near the abdomen.

The only buſineſs of the Moth in this ſtate is the multiplication of the ſpecies; that being performed the Male dies in two days. The Female evacuates a fluid of a tawny yellow colour upon which ſhe lays

lays her eggs; theſe eggs are at firſt yellow, and then turn grey and opaque; after that ſhe becomes languid and dies.

Thus the whole life of the Silk worm is circumſcribed in the ſpace of eight weeks; as our Summer for the ſpace of two months is as genial as in any country, though it cannot be called hot, it has warmth enough to rear the Silk worm: and as the White Mulberry will bear our climate, we may very lawfully draw the following concluſion, that Silk for our own conſumption may and ought to be produced at home.

(*A*) Orig. *Haud vilis pretii*, "Such as is not to be bought at an inferior price." As this ſpecies of the mulberry grows ſpontaneouſly about Quebec, the reſult of the Swediſh experiments very ſtrongly recommend our endeavouring to raiſe the Silk worm in that colony, at leaſt our repeating them upon the ſpot; as I underſtand from the original expreſſion, that the ſilk, though not of the very firſt quality, is good enough for all the middling works of our manufactures.

DISSER-

DISSERTATION XII.

ESSAY ON CORALS,

BY

HENRY FOUGT.

Am. Acad. v. 1. p. 177.

SUMMARY.

Name——Synonymes of ancient and modern writers——Etymology——definitions of Ray and Boerhaave division of Tournefort——all imperfect, the nature of Coral not being known——ranked with fossils by some writers on account of their

weight——calcareous nature——reſemblance to the Arbor dianæ——with vegetables—from their form—ſoftneſs under water——milky juices contained in their cells——Flowers diſcovered by Count Marſigli——with animals by Pyeſonelli——confirmed by the nature of the polype——Juſſieu's account of the animals themſelves——Scolopendra——Polypus——Meduſa——Sepia Corals formed by them——ſubject not yet decided——obſtacles preventing it——contribute to form calcareous earth?——the Baltic abounds with the moſt beautiful varieties of them——uſes——lime in Gothland abſorbents——Muſeums and Grottos——

CHAP. II. *Coral divided into Madrepore and Millepore——ſubdiviſions.*

---

§ 1. THE name of corals frequently occurs among the antient as well as modern writers; they were called curalia by Theophraſtus, Pliny and Ovid.

The

" The Cural ſtill its priſtine nature keeps."

Sidonius and others wrote corallum.

" Her ſnowy neck the Tyrian coral graced."

And among the moderns they have been followed by Tournefort. Dioſcorides gave to theſe productions the names of Lithophyton, and Lithodendron, or the Stone-plant and Stone-tree; Pliny, in ſome paſſages Gorgonia, and various ſpecies have likewiſe had different names given them, as the Fungites, Aſtroites, Porus, Madrepora, Millepora, Porpites, Reticularia, &c.

The moſt commonly received etymology of the word coral derives it from κορη αλος the offspring of the ſea.

§ 2. Corals have been differently defined by various authors.

Ray, in his Methodus emendata defines a Coral to be a ſubmarine plant without

flowers, of a very hard ſtony ſubſtance, gritty when chewed and making a grating ſound, brittle, and rattling when ſtruck againſt a hard body.

Boerhaave adds the following circumſtances to this deſcription: that it is reduced by fire to a calx, and effervesces with acids: and Tournefort divides them into two genera, appropriating the name of Coral to ſuch as had no viſible pores, and that of Madrepore to the others, which ſometimes are perforated with the form of a ſtar.

But theſe definitions are not adequate and complete, nor can a perfect and genuine character of theſe elegant ſea productions claſſed by the Naturaliſts under the general name of Coral be expected, as long as we remain in doubt whether they belong to the animal, the vegetable, or foſſil kingdom.

In the mean while if we refer them to vegetables, their ſtony calcarious ſubſtance eaſily diſcriminates them from all other plants: if they be produced by animals, and we call them their teſtaceous coverings, their firm adherence to ſolid ſubmarine bodies (for the moſt part by a very ſlender baſe) ſeems quite peculiar to them: if the Corals be ranked among ſtones, their beautiful internal ſtructure, their determinate figure impreſſed ſometimes with the form of ſtars, ſometimes variouſly perforated with pores, clearly diſtinguiſh them from every other ſpecies of ſtone.

§ 3. It may be gathered from the preceding obſervation, that the Corals have been referred by different authors to each of the three natural kingdoms.

The writers upon Foſſils have ranked them among ſtones for the following reaſons.

1ſt. In

1ſt. In their weight and ſubſtance they very nearly reſemble the hardneſs, and ſpecific gravity of ſtones.

2ndly. They have been not unfrequently found in the very bowels of mountains, by the curious. When expoſed to the action of fire for a certain time, and then immerged in water, they become a true calx.

3dly. Upon theſe grounds Guiſonæus in his letter to Bocconi, lays it down as a certainty "that no ſpecies of Coral is "a plant, but a pure refined mineral, "compoſed of a great proportion of a "ſalt joined with a ſmall quantity of "earth." He ſuppoſes alſo this beautiful compound to be formed by the precipitation of various ſalts and other mixed principles united by accident with vegetable matter diſſolved in water, in the ſame manner as the celebrated chymical metallic tree called the Arbor dianæ, which is made by ſilver refined in the cupel, with the addition of Mercury

cury and diſſolved in Aqua fortis; common water being poured upon the ſolution, the metal begins (by precipitating, attraction and the appoſition of part to part) in appearance to vegetate in the form of a ſhrub.

§ 4. The Botaniſts on the other hand, as Dioſcorides, Pliny; Cæſalpinus, Bocconi, Ray, Tournefort, and Count Marſigli have ranked the Corals among plants:

1ſt. Becauſe they aſcend in a ſtem and put out branches; every one preſerving its peculiar form, and at leaſt a wonderful reſemblance of ſpecies and genera is diſcoverable among them: beſide their ſtems are connected to a ſtone or rock, like the roots of vegetables fixed in the earth; having a very viſible ſimilitude to ſome kinds of trees, which they appear nearly to approach.

2ndy. This opinion is in ſome degree confirmed by the ſentiments of the ancients

cients, though perhaps not indiſputable judges in Natural Hiſtory: they thought that the Coral in its natural ſituation at the bottom of the ſea was ſoft, and that it derived its hardneſs from the contact of the external air*.

3dly. The obſervations of Boccconi may be further brought to ſtrengthen this who diſcovered a milky juice concealed in various ſmall cellular cavities under the bark in the extremities of the Corals: hence aroſe a ſuſpicion that they were not deſtitute of ſeed; and they even imagined that thoſe minute cells, which with the writers on this ſubject go under the name of pores, might be aſſigned as the proper ſeat of their fructification.

4thly. The diſcoveries of Count Marſigli lately publiſhed in his excellent Hiſtoire Phyſique de la Mer, ſeem to have put

* Dioſcorides mat. med. 5, 7.---Pliny 32, 2.---Ovid met. 15, 416.---Imper. Hiſt. Nat. 808.

put this point out of doubt: that illuſtrious Nobleman brings an extenſive variety of reaſons to prove that Corals ſhould be indiſputably claſſed among vegetables; he has even given very fine drawings of their flowers which he obſerved with great accuracy.

Geoffry, in his Materia Medica has given a brief hiſtory of this diſcovery: ——Count Marſigli preſerving a Coral newly taken up in ſea water, obſerved the Papillæ dilate by degrees, and ſhed ſmall drops of a milky fluid; then out of every papilla ſprung a white calyx of eight leaves, expanding in the form of a ſtar, with eight divaricating ſtamina nearly the length of the leaves of the calyx, and a ſimple piſtil: At laſt after eight or ten days, the flowers withered, turned yellow, contracted into a ſmall globule filled with a milky liquid, dropped off and fell to the bottom of the veſſel; theſe globules he conjectured to have been the fruit, and

that the ſeeds lay immerſed in the milky fluid. This ſingular appearance he firſt obſerved in the month of December, 1706, in a Coral juſt taken out of the ſea: keeping it ſome days in a veſſel of ſea water, he found a number of ſcattered ſtar-formed flowers coming out of different parts of it; upon withdrawing the water the flowers vaniſhed, but by reſtoring it they became again viſible, and the Coral remained in flower ten or eleven days.

§ 5. Laſtly thoſe very eminent Zoologiſts, Juſſieu, Trembley and Reaumur, have endeavoured to prove that Corals are neither ſtones or vegetables, but the production of worms —— Dr. Peyſonelli, of Guadeloupe, King's Phyſician, firſt propoſed this opinion in oppoſition to Marſigli and the Botaniſts——In 1727 he gave in a memoir to the Royal Academy at Paris, in which he acquaints them that he had diſcovered by very numerous and

and repeated experiments, that the flowers of Corals were nothing elſe than an immenſe number of minute animalcules, reſembling the Urtica marina; and the the Corals themſelves their habitations, and a beautiful aggregate collection of their teſtaceous coverings:——this at firſt ſeemed ſo paradoxical, that it was received as an agreeable romance, till Trembley's very accurate obſervations upon the Polype came out ſome years ago:--- but theſe diſcoveries being made, the obſervations of Peyſonelli grew into ſuch credit, that in the year 1741 that acute naturaliſt Juſſieu undertook a journey down to the coaſts of Normandy, where he proſecuted the enquiry into the nature of Corals with ſuch ſucceſs, that he brought back with him ſeveral fine obſervations in favour of this hypotheſis: Reaumur's preface to his 6th volume of the Hiſtory of Inſects is extremely well worth being conſulted upon this occaſion.

Juſſieu, in a letter to the celebrated Linnæus, dated the 1ſt of May, 1744, upon this ſubject, declares his thorough conviction not only that many ſpecies of Corallines which before had been claſſed among undoubted plants were the cruſtaceous coverings of certain marine animals, but that it was now evident what Zoophytes built and inhabited them: As this ſyſtem is entirely new, and is hitherto very little known, we think a liſt of theſe animalcules as they are enumerated by Juſſieu will not be an unacceptable detail to our readers——he informs us that

1ſt. *The* SCOLOPENDRA *is a zoophyte, with a cylindrical body, and two or four feelers.*

Theſe inhabit

1. The vermicular Tubuli----the dentalia, Sea pencil, and Tubularia.

2. Co-

2. Coralline called the Lobſter horn, Ray ſyn. 3, 33. n. 10.

3. Coralline called Sea-fir, R. ſyn. 35. n. 12.

4. Coraline thinly branched with alternate denticles, R. ſyn. 35. n. 13.

5. Coralline thinly branched, ſmall, repent, denticles oppoſite, approximated at the inſertion, R. ſyn. 37. n. 19.

6. Coralline more branched, ſmall, erect, R. ſyn. 37. n. 20. t. 2. f. 1.

7. Coralline, reſembling moſs, with a double row of denticles, unilateral, R. ſyn. 35. n. 13.

8. Coralline reſembling moſs, pinnate, the pinnæ and pinnulæ ſickle-formed, R. ſyn. 36. n. 16.

9. Co-

9. Coralline reſembling moſs, with alternate denticles; numerous capillary ſmaller diverging branches, R. ſyn. 36. n. 17.

10. Coralline reſembling moſs, with oppoſite denticles, ſmall ſtalk, procumbent, R. ſyn. 36. n. 18.

2nd. POLYPUS *with an oblong cylindrical body, the feelers at the circumference of the head.*

This genus inhabits

1. The Engliſh ſandy Millepore, R. ſyn. 31.

2. The Fucus reſembling the texture of linen or ſilk, R. ſyn. 42. n. 9.

3. The brittle white narrow Fucus, compreſſed, with the extremities apparently broken off, R. ſyn. 43. n. 10.

3d. ME-

3d. MEDUSA, *with a globular or conical body; the feelers filiform.*

Of this he gives four ſpecies.

4th. SEPIA, *the body oblong and depreſſed; with ſix ſhort tentaculæ, two longer; the mouth included in the body, two large eyes below the feelers.*

Of this genus he enumerates ſome ſpecies*.

§ 6. In this diverſity of opinions it is with difficulty we come to any deciſion; we muſt be compelled to praiſe the labours of theſe great men, but receive their opinions with a very philoſophical pyrrhoniſm: while each of the three parties bring arguments almoſt concluſive, why the coral ſhould at one time be claſſed with the foſſil, at others with the vegetable, or animal kingdom, we ſhall refrain all declarations in favour of any of theſe ſentiments; eſpecially as theſe enquiries being lately ſet on foot are yet to be

* See Note *(A)* at the end of this Eſſay.

be conſidered as being in an unfiniſhed ſtate; and that we muſt at preſent be content to acquieſce in the want of many deciſive informations which a future time may ſupply us with. Till therefore that certainty can be attained, we think it better to pronounce no judgement upon the affair, than an immature and precipitate one.——The purpoſe of this eſſay is not to diſcuſs every particular of the natural hiſtory of Corals, but to give the beſt deſcription in our power of thoſe growing upon our own coaſts: That brevity we wiſh to obſerve will not permit us to indulge in any further digreſſions, than ſuch as are barely neceſſary to ſatisfy thoſe who will be contented with a popular acquaintance with this ſubject, and to lay down what is abſolutely requiſite to underſtand the ſeveral parts of it.

§ 7. The obſtacles that have hitherto prevented a full inveſtigation of this perplexed queſtion of the nature of Corals, and

and hindered our having a faithful and accurate natural hiſtory of them, have been the following:

1ſt. They always grow at conſiderable depths of the ſea.

2d. Thoſe which are caſt on ſhore by the winds and tides are ſeldom found perfect.

3d. On ſhore they are expoſed to injury by the action of the air; they are covered with clay and ſand, or adhering to the adjacent bodies form into ſuch a ſolid maſs with them, that their forms are ſcarcely diſtinguiſhable.

4th. The ſpecies diſcovered in the Northern and Baltic Seas, and the Pacific Ocean, are very different; other places multiply theſe varieties; and to this we muſt add that the ſame individual ſpecies is frequently found with very ſtriking

variations of figure, and that Authors have made almoſt as many different ſpecies as they found individuals differing in form.

5th. The uſes which may be derived from a perfect knowledge of the Corals, is generally eſteemed to be much inferior to the expence of a collection, which to to be complete muſt be made in ſuch diſtant places. Navigators who by frequenting the moſt diſtant regions have the beſt opportunities for ſuch reſearches, look upon them with a very ſuperficial attention: nor are we to expect any lights in ſcience from the ignorance of a parcel of Coral fiſhers.

§ 8. Yet we muſt regard with admiration the great approximation of the Coral to each of the three natural kingdoms: ſo that though we cannot with certainty affirm that they ought to be excluſively ranged with ſtones, vegetables, or animals, yet there ſeem to be ſome properties

ties belonging to them, which at the ſame time point them out to belong to all.

We muſt add here that on thoſe ſhores where Corals are caſt up mixt with other extraneous bodies, they become a true calx:——Almoſt all calcarious rocks furniſh a great number of Corals, ſhells, and other petrifactions; though in ſome few they are leſs frequent: may they not aſſiſt in the generation of calx? but this is a queſtion the diſcuſſion of which we muſt relinquiſh to thoſe, who have better opportunities of purſuing it.

It may have its uſe here to obſerve briefly that moſt of our own coaſts produce Corals with the greateſt profuſion: Stobæus enriched his muſeum, which is ſtill preſerved in Lunden, chiefly from Oeland; the Carolinian iſlands in Gothland ſupplied that of Bromelli; but that extenſive and noble collection which our

illuſtrious Preſident brought from Gothland and the port of Capella, which we are now going to delineate, infinitely exceeds them both together: he thus celebrates theſe natural treaſures of Gothland, in his inaugural Oration on the neceſſity of travelling in our own country. "We admire the rich Coralline produc-" tion of the coaſts of India. But port " Capella,---at our very doors,---in Goth-" land,---and let thoſe who hear me give " the firmeſt faith to what I ſay, this one " equals, and even excels theſe treaſures " of the Eaſt: I have ſeen ſolid and en-" tire ſtrata of Coral extending furlongs " and miles upon this coaſt." This is likewiſe confirmed by Bromelli in his Lythographia Succica, ſp. 2. c. 2. § 1. " The ſcarcity of the Lithophyta will be " compenſated by the great number of " our Corals of which there is no coaſt " where they are found in ſuch multitude " and variety."

§ 9. As

§ 9. As the Corals have engaged our attention very little, but few of their uſes have been diſcovered.

The inhabitants of Gothland ſometimes prepare a lime from them, but very ſeldom.

They form a very ſplendid ornament to the Muſeums of the Naturaliſt, the gardens and grottos of the rich, and many other articles of oſtentation.

In medicine they are abſorbents, and have the ſame properties with the calcarious earths.

But uſes far more general will probably be derived from them, when we are ſo happy as to penetrate into thoſe obſcurities in which their generation and natural properties are at preſent involved; which without doubt will abundantly repay the labours of the inveſtigator.

The ſecond Chapter contains an enumeration of the ſpecies of Coral found on the ſhores of the Baltic divided into two genera; the Madrepora, and Millepora.

MADREPORA, *a Coral marked with radiated cavities.——This genus has three ſubdiviſions.*

SIMPLE; the Coral ſingle, marked with a ſingle ſtar.

COMPOSITE; conſiſting of many diſtinct, proliferous, ſimple Madrepores.

AGGREGATE; a Madrepore marked with many ſtars, ſo united that the diſſepiment of one is common to ſome other; and thererore conſiſting of a body not compoſed of ſimple diviſible Madrepores. Of this genus he gives nine ſpecies, with figures.

MIL-

MILLEPORA, *a Coral with ſimple cavities. Of this he has deſcribed eleven ſpecies.*

(A) Peyſonelli is undoubtedly to be eſteemed the original diſcoverer of the animal nature of the Coralline; what he advanced was afterwards very ſufficiently confirmed by theſe obſervations of Juſſieu. Ellis, after the publication of this Eſſay, went more extenſively into the ſubject; and the finiſhed elegance of his drawings have in ſome degree enabled his work to caſt the memory of his two predeceſſors (who had at leaſt the honour of anticipating the outline of his diſcoveries) into a kind of ſhade.

The general ſubſtance of his diſſertation upon the ſubject is as follows, 1ſt. That the Corallines are ramified Polypes, whoſe bodies are incloſed in a calcarious covering which puts on the form of a plant.----- 2nd. In ſome ſpecies the ſtem is an entire tube, ſome an aſſemblage of parallel tubes, in others they are interwoven: the body of the Polype is continued through theſe ſimple or compound tubes.-----3d. Their terminating branches frequently appear ſerrated owen to a number of minute denticles fixed upon them, every one of which contains a head of the Polype (or Hydra of Linnæus) ſheltered in it, which comes out and puſhes forth its tentaculæ in ſearch of prey.---4th. Beſide theſe denticles there are frequently found upon them

them veſicles of a larger ſize, containing a ſmall cluſter of young embryo Polypes attached to the parent animal by an umbilical cord; when theſe by their growth exceed the margin of the veſicle their tentaculæ begin to appear: theſe veſicles afterwards fall off, and are the rudiments of future Polypes.